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# Survey of Environmental Regulations Applying to Geothermal Exploration, Development, and Use

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February 1978

# SURVEY OF ENVIRONMENTAL REGULATIONS APPLYING TO GEOTHERMAL EXPLORATION, DEVELOPMENT AND USE

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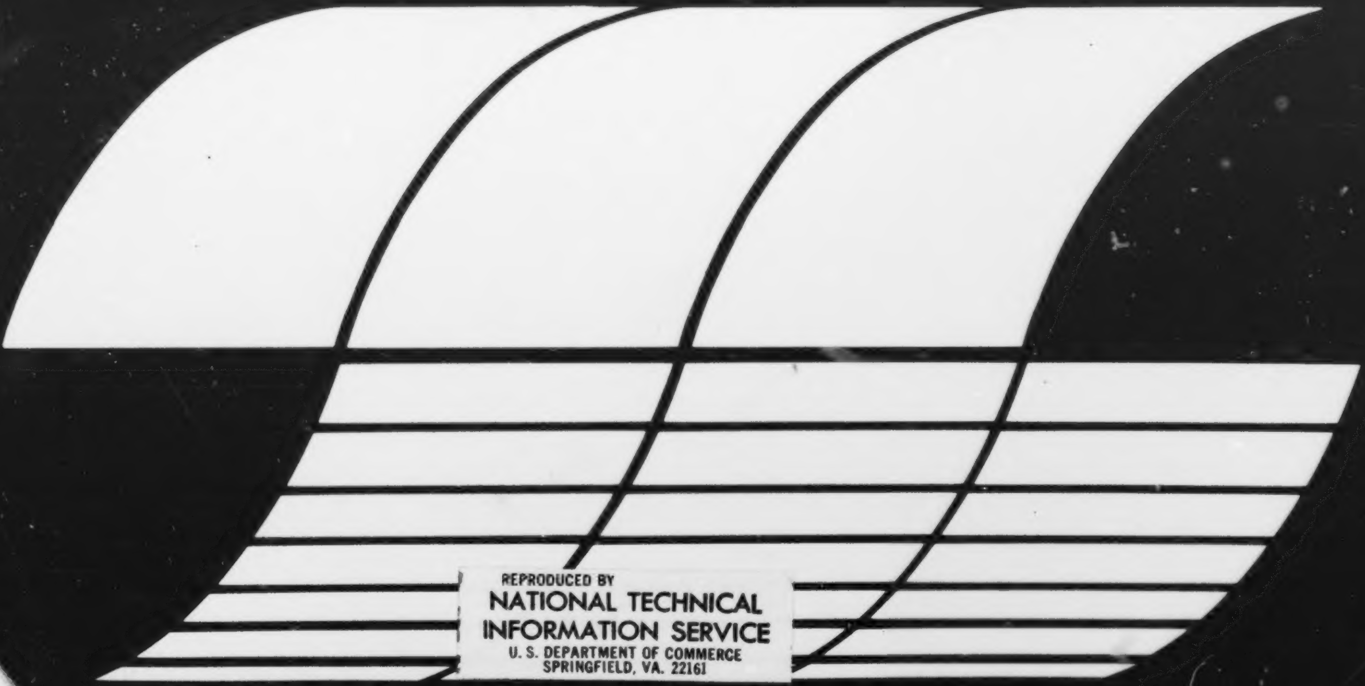
Energy-Environment
Research and Development
Program Report



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Federal, State, and local environmental laws and regulations that apply to geothermal energy development are summarized. Most attention is given to those regulations which deal with air pollution, water pollution, solid wastes and impact assessments. Analyses are made of the regulations with respect to resource definition, pollutants currently not controlled, duplicity and overlap in permit and impact assessment requirements, the lack of uniformity of regulations between states, and the probable future approaches to the regulatory problems.

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# SURVEY OF ENVIRONMENTAL REGULATIONS APPLYING TO GEOTHERMAL EXPLORATION, DEVELOPMENT, AND USE

by

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This report has been reviewed by the Industrial Environmental Research Laboratory, U.S. Environmental Protection Agency, and approved for publication. Approval does not signifiy that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

# FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory-Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

This report examines federal, state, and local environmental laws and regulations that affect the development of geothermal energy. The emphasis is upon those regulations dealing with air and water pollution, solid wastes, and noise. The report should be of interest to those at all government levels who must implement their numerous provisions, and those developers who must abide by them.

Further information on this subject can be obtained from the Power Technology and Conservation Branch of IERL-Ci.

David G. Stephan
Director
Industrial Environmental Research Laboratory
Cincinnati

# ABSTRACT

This report presents the results of a survey of local, state, federal, and federally-approved environmental control ordinances, statutes, regulations, and standards which are applicable or potentially applicable to geothermal development. Requirements relating to air, water, and noise pollution control, solid waste disposal, control of subsidence and radiation, and erosion and sedimentation control are set forth. The effects of federal and state environmental impact review procedures are also evaluated.

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The assistance of Bureau of Land Management and U.S. Geological Survey personnel is greatly appreciated as is that of numerous people within the air, water, noise, and solid waste programs of EPA who provided up-to-date information expeditiously. Our especial thanks are also extended to the many state and local employees who participated; the objectives of this study could not have been realized without their generous contributions.

# SECTION I

# CONCLUSIONS

## INTRODUCTION

This report presents the results of a survey of existing legal requirements applicable or potentially applicable to the production and use of geothermal resources. The survey constituted Phase I of a comprehensive Environmental Protection Agency (EPA) study of the environmental ramifications of geothermal development. Thus, the report focuses almost exclusively on the local, state, federal, and federally-approved ordinances, statutes, regulations, and standards designed to minimize adverse environmental effects of pollution sources. These documents relate to such factors as air and water pollution control, noise reduction, land disposal of wastes, and subsidence, and some are specifically directed to geothermal activities while others are more general requirements which, it is assumed, will be applicable to geothermal development. The criteria which mandate the preparation of environmental impact evaluations are detailed along with the information which such assessments must develop. In addition, specific engineering and documentation requirements during drilling and testing of wells are identified.

The term "production and use" is employed throughout the report to mean: the recovery, by any method, of geothermal resources and their subsequent use in electric power generation or in any other application. The term "geothermal resource" is used in a broad context to include four types of systems -- vapor-dominated, hot-water, hot dry-rock, and geopressured.

These systems may be described as follows:

Vapor-dominated: Vapor-dominated geothermal resources contain saturated or superheated steam. Presently, only six major reservoirs of this type have been identified worldwide. In the United States, The Geysers field in California, the only commercially producing U.S. geothermal field, is of the vapor-dominated type.

Hot-water or Liquid-dominated: This kind of geothermal resource consists of naturally-occurring liquid water or a two-phase mixture of liquid water and steam at an elevated temperature and pressure. This is the most common type of hydrothermal resources. Hot-water fields are located throughout the western United States.

Hot dry rock: Hot dry rock geological formations have an abnormally high heat content, but do not contain sufficient water or sufficient rock permeability to permit withdrawal of hot water as a heat transport medium. They have some potential, however, for use with circulating surface water as a heat exchange medium.

Geopressured: Geopressured geothermal fields are deep zones of pressurized water with widely varying salinity in which the pressure is caused by the weight of the geological formation (overlying the trapped fluid), which is greater than the weight of an equal volume of fluids. Areas for potential development are located in the Gulf Coast states and often contain large amounts of methane which may be exploitable either alone or along with the geopressured resources.

The survey centered on 15 states where geothermal resources have been identified. These include: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Louisiana, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington, and Wyoming. No information was developed which suggests imminent geothermal production in any other states.

The report is structured to present an overview of the environmental requirements of geothermal exploitation; an analysis of existing federal/state/local environmental control mechanisms to which the geothermal industry is presently subject or may become subject in the future; and identification of constituent or categorical limitations in the form of summaries of specific legislation and/or regulations. It does not address other types of legal provisions with potential effect on geothermal development. It excludes those which pertain to acreage limitations, fees, rents, royalties, rate structures, mineral vs. geothermal definition, zoning, tax structure, conversion rights, acquisition, and leasing methods.

The second phase of the program involves the identification of the physical-chemical characteristics of geothermal deposits in this country, the potential for their exploitation, current and developmental processes for exploitation, the pollutional potential of these processes, and the available technology for environmental control. When this information is developed, the environmental requirements identified in this report will be further assessed -- i.e., as to whether the applicable standards and regulations make the best use of the control technologies available or, on the other hand, whether there are instances in which the technology cannot meet the stringency of the standards and regulations. No attempt is made to undertake final evaluation of this type in this Phase I report.

The selection of the standards and regulations presented was based on existing information on the potential parameters of wastes generated by geothermal activities. This approach is complicated to a degree by the well-known fact that the constituents of geothermal resources will vary widely from area to area and perhaps even from well to well in the same area, and the wastes produced will thus similarly differ in characteristics and quantities.

The report does not present a "laundry list" of requirements of each statute or regulation discussed. Instead, an overview of common provisions is evolved and unique provisions are described in detail. This technique is sound because of the proclivity of jurisdictions to emulate the environmental requirements of others.

The report documents uncertainties which have created what might be termed a "chicken-and-the-egg" situation in terms of environmental control for the emerging geothermal industry. It raises the question of how much development will occur in the face of minimal certainty as to the precise environmental control requirements which will be applied, and, thus, the range of technologies and expenditures involved. On the other hand, it might be asked, will federal, state, and local government agencies be motivated to use tight budget and manpower resources to develop the detailed information upon which such limitations must be based until the reality of the industry and its wastes are present?

The term "minimal certainty" relates only to the knowledge of specific "numbers" or control technologies to be mandated, because there is plentiful certainty in today's climate that extensive pollution control will ultimately be required. How soon such constraints will be imposed is another question in face of: 1) the national desire to develop new energy sources; and 2) the desire in some localities and states to expand their industrial economy. Even when applicable regulations are adopted, the degree of enforcement may be tailored to prevailing priorities.

Beyond these uncertainties specific to geothermal development, major changes in basic environmental control legislation and regulation are being considered by the Congress and within EPA, and this report may well be somewhat out-of-date before it is printed. This is unavoidable in a field so relatively new that policies and technologies must continually change to fit developing needs.

## OVERVIEW OF ENVIRONMENTAL REQUIREMENTS ATTENDANT TO GEOTHERMAL DEVELOPMENT

The federal Geothermal Steam Act of 1970 (P.L. 91-581) was the first legislation designed to permit the exploitation of a resource on federal lands to prescribe blanket environmental protection. The Secretary of the Interior has used his unlimited authority to protect water quality and other environmental qualities to promulgate geothermal leasing regulations which are also unique in the mineral development/environmental protection interface. The regulations (Title 30 CFR, Parts 270 and 271, and Title 43, Parts 3000 and 3200) and related Geothermal Resources Operational Orders (GRO) mandate that federal geothermal lessees comply with all applicable federal, state, and local environmental standards and any more stringent standards which a Geological Survey (USGS) Area Geothermal Supervisor may impose. This directive includes control of all forms of air, land, water, and noise pollution, including but not limited to the control of erosion and the disposal of solid, liquid, and gaseous wastes.

This language contrasts sharply with the more permissive language of the regulations under which oil and gas lessees operate under the Mineral Leasing Act of 1920 (Title 43 CFR, Part 3000). Until this dissimilarity in treatment is narrowed, geothermal development is subject to some degree of competitive disadvantage.

This situation results at least partially from the fact that the U.S. Congress adopted the Geothermal Steam Act as single-purpose legislation -- i.e., as opposed to extending the coverage of the Mineral Leasing Act. This offered the opportunity to impose environmental controls on a new, emerging industry which probably would have been more difficult to apply to a more entrenched industry. Most of the 14 states with geothermal statutes providing for the leasing and/or conservation of geothermal resources have also chosen the single-purpose approach.

Some of these statutes and/or the implementing regulations -- or the regulations alone in the case of Wyoming which has no geothermal statute -- spell out very detailed environmental control requirements, although they generally stop short of numerical standards on pollutant parameters, except in a few cases for noise and odors.

The standards themselves are found in federal, state, and local regulations dealing with all sources or potential sources of pollution which relate specifically to control of air, water, or noise pollution or other environmental degradation. It is assumed that geothermal operations are subject to these regulations, or will become subject to them when certain activating steps are taken as described below.

Geothermal activities are also subject to other federal laws such as the Endangered Species Act of 1973; National Historic Preservation Act of 1966; the Archaeological and Historical Preservation Act of 1974; Coastal Zone Management Act of 1972; Wild and Scenic Rivers Act; and others, along with implementing regulations. Their application is either direct or through stipulation in federal geothermal leases.

## ANALYSIS OF FEDERAL/STATE POLLUTION CONTROL REQUIREMENTS

Nearly all of this country's environmental control programs are basically structured on federal/state interaction. This is true of the programs established by the Clean Air Act (P.L. 91-604); the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500); the Safe Drinking Water Act (P.L. 93-523); and the Noise Control Act of 1972 (P.L. 92-574), all of which are administered at the federal level by EPA. The provisions of these statutes and implementing regulations are applicable to all industries, including geothermal production and use. However, their applicability to federal geothermal lessees is two-fold because compliance with them is a condition of the lease. Regulation of industry's practices in land disposal of wastes is not yet within EPA's purview, although federal geothermal lessees are again subject to federal land disposal requirements through their leases. Neither does P.L. 92-500 give EPA direct authority to regulate erosion/sedimentation control, but this, too, is a function of geothermal leases. Some of the state geothermal regulations represent the only effort to regulate subsidence, an effort which has no counterpart in federal regulation.

### Air Pollution Control

The primary tool in air pollution control is the emission standard, which limits the amount of a pollutant which may legally enter the atmosphere from any source. The Clean Air Act provides several mechanisms for establishing emission standards. EPA itself promulgates such standards for hazardous pollutants and sets performance standards for new sources (NSPS) in designated industries which are a form of emission standard. It is not anticipated that either of these types of standards will impact geothermal development in the near future.

In the other two emission standard procedures established by the Clean Air Act, the states set the numerical standards. This mechanism is triggered either by promulgation of a national ambient air quality standard -- a goal for acceptable air quality based on scientific criteria -- or adoption by EPA of new source performance standards for an industry. The latter procedure requires the states to adopt emission standards for existing sources in the same industry. This is expected to be the primary method used to initiate emission standards in the future.

The states may on their own set emission standards on any pollutant from any stationary source, and some have begun to address hydrogen sulfide, for example, for which there is no federal ambient air standard. On the other hand, if states fail to adopt emission standards in response to national ambient air standards or NSPS, EPA may then promulgate such standards for the state.

Geothermal operations are not presently subject to "significant deterioration" regulations which would severely restrict the levels of sulfur dioxide and particulates which may be emitted in pristine areas.

## Water Pollution Control

The two major water pollution control tools are numerical limitations and new source performance standards on pollutant parameters of the effluents of pollution sources and discharge permits acquired under the National Pollutant Discharge System (NPDES). Both of these mechanisms are established by the 1972 amendments to the Federal Water Pollution Control Act. The effluent limitations, standards of performance for new sources, and required treatment and control technology are set by EPA on an industry-by-industry basis, and none have so far been applied to the geothermal industry. As a result, the effluent limitations, including thermal restrictions, prescribed for these operations by NPDES permits will of necessity be established on a case-by-case basis and will be based on state water quality standards applicable to the water which will receive the discharge. Since these may vary from one reach of a stream to another the potential exists for wide variations in applicable limitations. The degree of impact of this situation depends on the extent to which the industry utilizes or is permitted to utilize reinjection of the resource after use in lieu of surface discharge. As an example, the permit application to operations at The Geysers permits no surface discharge.

The Act applies the provisions of the National Environmental Policy Act to the issuance of an NPDES permit for a new source of pollution. This requires a very complex and sometimes lengthy assessment of the potential impact it will have on the environment. However, until EPA proposes new source performance standards applicable to geothermal effluents, these operations are not defined as "new sources" and are not subject to this provision of the Act. However, it is unlikely that much, if any, geothermal development will take place without being subjected to prior environmental scrutiny because the federal geothermal regulations cited above require it and some states have their own NEPA-type statutes as discussed below.

The toxic effluent standards or prohibitions required by the Act are applicable only to designated sources of pollution. It is probable that water quality criteria for 65 toxic pollutants to be established by EPA for use as guidelines by state and federal agencies in issuing NPDES permits will impact geothermal operations before applicable industry-specific standards are set.

EPA is developing regulations covering outfall discharges to the oceans, a practice which could be an attractive means of disposing of brines or other geothermal wastes for such operations situated in coastal areas.

## Control of Underground Injection

EPA has proposed regulations pursuant to the Safe Drinking Water Act which give states primary enforcement authority over underground injection and provide for flexibility in their programs according to need. The burden will be placed on the underground injection operator to demonstrate that his operation will not endanger the quality of present or potential water supplies. Endangerment is defined as requiring the use of new or additional treatment to meet a national primary drinking water regulation or otherwise to prevent a health risk. In general, waters with a total dissolved solids content of 10,000 mg/l or less are to be protected, although states may exempt aquifers which are more valuable for oil production, are severely contaminated, or are impracticable for water supplies because of their location.

The regulations do not force the 14 states which presently ban injection to permit the practice -- none of these states are among the 15 surveyed -- and they allow states to adopt more stringent requirements than they impose.

EPA is seeking comments on the requirements to be imposed on multiple use wells used for subsidence control prior to November 15, 1976.

## Solid Waste Disposal

All states have some regulatory authority over land disposal practices and many are moving in the direction of solid waste management -- i.e., treatment and disposal according to the nature of wastes. The trend is toward the use of "secured" landfills for hazardous wastes. These are sanitary landfills which incorporate leachate monitoring and treatment, adequate diversion and control of surface water, and impervious containment of wastes. California already requires this advanced type of disposal facility for brines from geothermal plants and drilling muds containing toxic materials. Chromium is a common constituent of the muds used in geothermal drilling because of its ability to withstand heat and would result in a "hazardous" classification. The presence of other heavy metals and/or hydrogen sulfide absorbed during drilling in high sulfide areas may also necessitate special handling. However, if present California practice is an indicator, such treatment will not be required for waste muds shown by chemical analysis to be free of toxic problems.

The costs for secured landfill can run up to several times the cost of ordinary landfilling in some instances. Geothermal operations in remote areas may have to provide their own, as has occurred at The Geysers, or haul wastes great distances, which has also been required.

Federal geothermal lessees are required to dispose of toxic drilling muds and the containers in which mud additives are received in a manner approved by a USGS Area Geothermal Supervisor and in conformance with applicable federal, state, and regional standards.

### Control of Noise

The Noise Control Act of 1972 (P.L. 92-574) vested the primary control of noise with state and local governments, but retained federal regulatory authority over the production of four categories of low-noise level products -- construction and transportation equipment, motors or engines, and electrical or electronic equipment. Until EPA promulgates noise regulations on a product, the states are free to set their own time-of-sale and in-use regulations. When EPA does issue regulations, the state regulations must be consistent.

Federal geothermal lessees are limited to noise levels not exceeding 65 dB(A) at a distance of 201 m (660 ft). Nearly all noise measurements of individual operations taken at The Geysers which are not located on federal land, exceed this standard.

### Control of Subsidence

The few state attempts to regulate subsidence are divided between surveillance measures, such as survey, benchmark, and monitoring requirements, and "after-the-fact" requirements. The latter involve total or partial termination of operations if subsidence is found.

### Control of Radiation

There are state water quality standards on radiation which could conceivably apply to geothermal wastes containing radon or other natural radioactive material. However, this study concluded that regulations designed to implement state agreements for controlling the classes of radioactive materials which are under the jurisdiction of the federal Nuclear Regulatory Commission have no application to geothermal operations. EPA has been precluded by the Supreme Court from promulgating effluent limitations for any of these materials.

## ENVIRONMENTAL ASPECTS OF THE FEDERAL GEOTHERMAL LEASING AND DEVELOPMENT PROGRAM

The Bureau of Land Management (BLM) in cooperation with the USGS formulates the general requirements of geothermal leases and the special stipulations attached to them. BLM also monitors for compliance with environmental requirements outside the operating area and USGS determines compliance within the operations.

The geothermal leasing regulations cited above mandate a number of environmentally-related actions by the lessee in addition to the land disposal practices and noise control described previously. In general, lessees must comply with all applicable federal, state, and local water and air pollution control standards; comply with all Department of the Interior and EPA rules pertaining to the use of pesticides and herbicides; employ such soil and resource conservation measures as the Supervisor deems necessary; take precautions to minimize land subsidence or seismic activity; take esthetics into account in designing facilities; employ measures to protect fish and wildlife and their habitat; conduct activities on known or suspected archaeological, paleontological, or historical sites in accordance with lease terms or special instructions; and restore all disturbed lands in an approved manner. The lessee's plan of operation must disclose the means by which he will implement this list. Monitoring is required for one year prior to production to develop baseline data on existing air and water quality, noise, seismic and land subsidence activities, and the ecological system of the leased land.

The USGS Area Geothermal Supervisor is authorized to shut down operations he determines are causing or can cause pollution. Except in extreme cases, the operator is given a chance to remedy the problems.

GRO Order No. 4, which mandates environmental protection for all stages of geothermal exploration and development on federal lands in the USGS central and western regions, spells out the above measures in greater detail. And, it is to be remembered that the Supervisor is empowered to set more stringent restrictions in specific field orders.

## STATE STATUTES/REGULATIONS APPLICABLE TO GEOTHERMAL DEVELOPMENT

The study of the state air and water pollution control regulations pointed up the fact that very few of the potential pollution parameters of geothermal wastes are covered by existing numerical standards. The ambient air quality and emission standards which are in force today are geared mostly to the products of combustion and processing of materials, and only a handful attempt to limit the levels of the noncondensable gases which may commonly result from geothermal development.

The predominance of states have promulgated emission standards for only the six air contaminants for which EPA has set ambient air standards: sulfur dioxide, particulates, hydrocarbons (excluding methane), carbon monoxide, photochemical oxidants, and oxides of nitrogen. None of the gases in this list are found in the various published lists of gases typically associated with geothermal resources. There is evidence in the literature, however, that sulfur dioxide is a natural product of some deposits, and it occurs as a reaction product of hydrogen sulfide at The Geysers power plant. It is doubtful that the hydrocarbon standards which exclude methane and those for carbon monoxide, oxides of nitrogen, and photochemical oxidants will have any significant effect on geothermal development.

Water quality standards more frequently embrace a larger number of the expected geothermal waste constituents, but this fact is offset by the lack of numerical effluent limitations applicable industrywide. This circumstance may engender potential disparity in case-by-case treatment in specific requirements as noted above, and uncertainty as to what the limitations may be in any given case.

The general uncertainty is further complexed by the question of whether the nature of some existing standards will permit their application to geothermal wastes. The control of particulates illustrates this potential problem.

In the most popular particulate emission standard in the geothermal states, particulate emissions are calculated on the basis of process weight per hour. While process weight can be interpreted to mean the water or steam input into a geothermal electric generating unit, for example, enforcement probably would be difficult. Some of the state standards exclude liquid or gaseous fuel from the weight calculation, and Wyoming expressly excludes all water and steam.

The present environmental control situation for the geothermal industry is by no means static, however, in view of mechanisms at the federal, state, and local levels of government which permit them to adopt new standards and to develop new industrywide restrictions.

## Geothermal Statutes and Regulations

The state statutes and regulations adopted for the purpose of guiding geothermal development provide for leasing and/or conservation programs. They commonly require the use of drilling procedures, equipment, and fluids which will prevent entry of the geothermal resource into groundwater and also prevent blowouts. Advance notice is required of the intent to drill, redrill an abandoned well, deepen a well, plug, alter or remove casing, or convert a producing well to an injection well. A permit is sometimes required for these activities.

In some cases directional drilling is prohibited, and, in others, distance from the property line requirements are adjusted to accommodate directional drilling. Well-spacing if often regulated.

Most of the regulations mandate any action necessary to prevent soil erosion, pollution of surface or groundwater, air and noise pollution, and hazards to public health and safety. It is frequently required that methods for achieving these steps be spelled out in a plan of operation. Noise associated with air drilling is specifically cited for minimization as are odors.

The majority of the regulations do not specifically address the legality of reinjection of fluids, but so far as is known, none of these states strictly prohibit the practice.

## State NEPA-Type Statutes and Regulations

Several geothermal states have adopted statutes which are analogous to the National Environmental Policy Act. These include California, Hawaii, Montana, Nevada, Utah, and Washington. Others which do not yet have such a law engage in some type of agency review of proposed actions. These include Alaska, Arizona, Colorado, Oregon, and Texas.

The California Environmental Quality Act of 1970 and the guidelines for implementing it are probably as comprehensive as any state documents of this type. Geothermal activity becomes subject to their provisions by virtue of the fact that it falls within the definition of "discretionary projects" which require an environmental impact report if they have a potential for signficant environmental effect. The definition of such effects includes several environmental impacts which may accompany geothermal development, such as the possibility of contaminating a public water supply system or adversely affecting groundwater.

As has been the case with the application of the environmental evaluation procedure nationally, this Act and the guidelines have been blamed for delays in achieving permit approval. In an expansion of The Geysers, it took 38 months from the date of application to complete a final environmental impact report on a new unit. This compares with an average of 5.3 months for the whole permit procedure for earlier units.

The guidelines undertake to avoid duplication of environmental evaluations by: (1) requiring only one report for individual projects which are part of a total undertaking, and (2) accepting, under certain conditions, impact statements prepared pursuant to NEPA. Nevertheless, three levels of government -- federal, state, and local -- have all studied the same area in the vicinity of The Geysers, and a separate report has been required for every well.

## Air Pollution

Many of the provisions of the air pollution regulations of 14 states and four California air pollution control districts (APCD) are similar to each other and identical in some cases. This similarity leads to the conclusion that potential geothermal developers are not likely to find a state which is an air pollution control "haven," so to speak, and this conclusion is supported by the fact that the history of environmental regulation indicates very strongly that what one state imposes today may very well be adopted by another tomorrow.

All states require some form of permit for the construction, modification, and operation of sources or potential sources of air pollution and a similar process for existing sources. The information required is usually quite comprehensive, and some of it, such as emission character and control equipment efficiencies, will be difficult for geothermal applicants due to lack of experience. Most regulations provide for variances conditional on unreasonable hardship.

Odor will be a troublesome parameter for the control agency and the geothermal operator alike. These standards range from very general requirements to flat prohibitions -- neither of which is conducive to enforcement -- to such specific limitations that compliance will be difficult. A few are based on detectability after a prescribed number of dilutions with odor-free air.

### Particulate Standards--

The most common particulate standard in the geothermal states has the effect of limiting the emission rate of particulate matter to 1.23 kg (2.75 lb) for the first 450 kg (1000 lb) of process weight per hour, with limits up to 31 kg (69 lb) at 450,000 kg (1,000,000 lb) process weight per hour. This standard is employed in Idaho, Nevada, Montana, Oregon, for existing sources in Wyoming, Arizona for areas outside Phoenix and Tucson, and the four California APCD's in which Lake, Mendocino, Sonoma, and Imperial Counties are located. Other states use the same standard in a somewhat more stringent form.

Another type of particulate control is a limitation on the opacity of a plume which is No. 1 Ringelmann in most states surveyed. It is important to note that in many cases opacity which exceeds the standard because of the presence of uncombined water or condensing water vapor is not a violation.

### Sulfur Dioxide Standards--

Several of the states surveyed have no $SO_2$ emission standards applicable to geothermal operations because they relate only to the combustion of fuels or to other specific industries. These include Idaho, Montana, New Mexico, Oregon, and Wyoming. The emission limitations of other states range from 1,333,500 $\mu g/m^3$ (500 ppm) to 5,334,000 $\mu g/m^3$ (2000 ppm).

The values of Hawaii's ambient air standard for sulfur dioxide are considerably more stringent than those of the federal standard -- i.e., an annual mean limitation of 20 $\mu g/m^3$ (0.008 ppm) as opposed to 80 $\mu g/m^3$ (0.03 ppm) and a 24-hour peak maximum of 80 $\mu g/m^3$ (0.03 ppm) as opposed to 365 $\mu g/m^3$ (0.14 ppm). Some of the other states employ lower values than the federal standards, but this is by far the most restrictive.

### Hydrogen Sulfide Standards--

Four of the 15 states have an $H_2S$ ambient air standard, two have promulgated $H_2S$ emission standards, and three others have some type of standard on total reduced sulfur compounds. The values in these standards range widely and are accompanied by complex qualifications in some cases. They are tabulated in Section V of this report.

The Northern Sonoma County APCD in California, site of The Geysers, has adopted a new set of regulations establishing specific $H_2S$ emission standards applicable to both geothermal power plant emissions and those of pre-power emissions -- well drilling, testing and clean-up, well bleeds, and other attendant functions.

### Sulfuric Acid Mist Standards--

Standards governing the emission of sulfuric acid mist are significant to this study because this substance could be formed in the oxidation of $H_2S$ in power production operations, creating a problem in the vicinity.

The Idaho ambient air quality standards applicable to sulfuric acid mist are as follows:

Primary and secondary standards: Max. 24-hr. concentration - 12 $\mu g/m^3$ not to be exceeded more than once/month

Max. 1-hr. concentration - 30 $\mu g/m^3$ not to be exceeded more than twice/week.

The Louisiana values for sulfuric acid mist, sulfur trioxide, and any combination thereof are very similar. Sulfur trioxide combines with moisture in the air to form sulfuric acid mist.

Water Pollution Control

State water quality standards are goals for acceptable water quality for specific uses. They consist of water quality criteria and plans for their enforcement or implementation. The criteria place limits on the concentrations of various parameters and restrictions on changes in pH, temperature, or other characteristics of surface water which if not exceeded will achieve the desired quality.

Most state waters are classified according to use. Classifications may include entire water bodies or may vary from reach to reach of the same stream. The criteria vary in stringency according to the degree of purity required for the designated classification of use. The values may be more restrictive than the federal criteria if a state so desires.

Federal water quality criteria for domestic water supplies of potential interest to the geothermal industry include those for arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nitrate nitrogen, dissolved solids and salinity, and zinc. Parameters covered for other uses such as protection of wildlife include beryllium, boron, total dissolved gases, nickel, and hydrogen sulfide. All of these substances have been identified as associated with geothermal resources in one field or another in this country, and all of them, except beryllium and hydrogen sulfide, are subject to water quality standards in some of the 15 states surveyed. The federal criterion for hydrogen sulfide for fish and other aquatic life, fresh and marine water, is 2 $\mu g/l$ of undissociated $H_2S$.

Most state water pollution control regulations contain an antidegradation requirement that waters whose quality exceeds the standards will be maintained at their existing high quality. They are also likely to include a requirement that, water quality standards notwithstanding, where a higher quality can be achieved, it is to be attained by the best practicable treatment and/or control of wastewaters.

There is a range in thermal standards among the 15 states, and even within states, where both warm water and cold water fisheries must be considered. There may also be differences in standards between fresh waters and estuarine and coastal waters; between streams and lakes; between use classifications; or between seasons of the year. For example, the maximum permissible increase in surface water temperature found is commonly set at 2.8°C (5.0°F), but the states often set a lower maximum allowable rise for certain specified waters:

| State | Water | Allowable Rise |
|---|---|---|
| Alaska | Cold | 1.1°C (2.0°F) |
| Louisiana | Lakes & reservoirs | 1.7°C (3.0°F) |
| Louisiana | Estuarine & coastal waters (Oct.-May) | 2.2°C (4.0°F) |
| Louisiana | Estuarine & coastal waters (June-Sept.) | 0.83°C (1.5°F) |
| Texas | Tidal reaches & other coastal areas (fall, winter, & spring) | 2.2°C (4.0°F) |
| Texas | Tidal reaches & other coastal areas (summer) | 0.83°C (1.5°F) |

The most stringent temperature limitation found is "no measureable increase" which, in at least one case, is interpreted as 0.3°C (0.5°F), but in others it means no change at all. This usually applies to waters of the highest use classification, although the State of Washington applies it to all lakes. The temperature standards applicable to fresh water streams and marine waters in Washington are calculated on the basis of equations and will vary from water body to water body. Oregon places an 0.3°C (0.5°F) limit on changes incurred from one single source in waters of 17.5°C (63.5°F) or less, and a 1.1°C (2.0°F) limit from all combined sources when the water temperature is 16.7°C (62.0°F) or less.

The turbidity standards range from no increase in some of the higher use classifications up to a level which will not cause water turbidities to exceed 50 Jackson Turbidity Units. In some cases, higher permissible values are given for warm waters, and lower values are applied to cold waters.

## Disposal of Waste on Land

While some of the solid waste disposal regulations reviewed appear to be directed primarily toward land disposal sites operated for public use, they are not interpreted to preclude private landfill with the required approval or permit. This type of regulation is important to the geothermal industry because of its potential effect on the disposal of drilling fluids containing substances deemed by regulatory authorities to be hazardous because of their degree of toxicity.

The regulations of five states of those surveyed specifically require some sort of impervious landfills for wastes which are variously described as "chemical," "toxic," or "hazardous" wastes. Four others indicate that approval may be contingent on this feature. Three states specifically require that hazardous wastes will be rendered non-hazardous through treatment prior to land disposal and another requires this measure when "possible."

In some states, regional or local authorities are authorized to set more stringent disposal standards than those imposed by the state. In one state, Hawaii, each county is directed to see that facilities for the disposal of hazardous waste materials are available.

## Noise Regulation

Five of the surveyed states reported existing environmental noise statutes. These states are California, Colorado, Hawaii, Oregon, and Washington. Hawaii, Oregon, and Washington also have implementing regulations.

The noise standards contained in the Colorado statute and the regulations of the three states can be summarized as follows:

| State | Zone | Daytime* dB(A) | Nighttime* dB(A) |
|---|---|---|---|
| Colorado | Residential | 55 | 50 |
| Hawaii | " | 55 | 45 |
| Washington | " | 60 | 50 |
| Colorado | Commercial | 60 | 55 |
| Hawaii | " | 60 | 50 |
| Washington | " | 65 | 55 |
| Colorado | Industrial | 80 | 75 |
| Hawaii | " | 70 | 70 |
| Washington | " | 70 | 60 |
| Oregon | All except | 55-75 | 50-60 |
| Oregon | Quiet Zones (wilderness areas, parks, etc.) | 50-60 | 45-55 |

*These are variously set at 7:00 a.m. - 7:00 p.m. and 7:00 p.m. to 7:00 a.m.; 7:00 a.m. - 10:00 p.m. and 10:00 p.m. - 7:00 a.m.

There are a number of qualifications to these regulations which, for example, permit the prescribed limits to be exceeded for a given period during any hour; which limit noise of construction to specific hours; or which mandate muffling of construction equipment which requires an exhaust of air or gas.

## COUNTY GEOTHERMAL ORDINANCES AND REGULATIONS

The county regulations designed to govern geothermal activities most often require a use permit and the criteria for granting or not granting the permit is the area of most variability among them. Sonoma County, California, however, does not require such a permit for geothermal operations except on reserved agricultural lands where actual extraction requires a permit. The regulations of Napa County, California, embrace the most restrictive criteria for denial of permits encountered throughout the study.

Development of a geothermal element of the county's general plan is underway in Imperial County, California, and presently geothermal production operates under an interim plan. Imperial, Plumas, and Lake Counties in California and Malheur County in Oregon employ very specific noise limitations.

A 1973 Plumas County special use permit does not commit the county to future development of the geothermal field, approval of which depends on review of extensive information on the character of the field supplied when testing is completed. If field development is permitted, a closed production system will be required for a fluid phase geothermal system or a minimum 80 percent reinjection system for a gaseous phase system.

Mono County, California, where the land is 79 percent federally-owned, has experienced the inability to exercise any local jurisdiction over geothermal development because of what its spokesman described as "multiple layers of federal bureaucracy." The county's position now is that it is without jurisdiction.

## SECTION II

## OVERVIEW OF ENVIRONMENTAL REQUIREMENTS ATTENDANT TO GEOTHERMAL DEVELOPMENT

### COMPARISON WITH REQUIREMENTS IMPOSED ON OTHER MINERAL PRODUCTION

The federal legislative/regulatory structure which has historically attended the production of oil and gas on federally-owned land is the one most closely akin to the structure which has more recently been developed for the exploitation of geothermal resources and may be used as a basis for comparison of the treatment of the newer industry. The requirements which relate to facets such as lease terms, rents, royalties, unitization, multiple use, and other factors previously enumerated are not significantly different. However, requirements with the objective of environmental protection or enhancement differ greatly.

It was not until passage of the Geothermal Steam Act of 1970 (P.L. 91-581) that legislation designed to permit the exploitation of a resource on federal lands included a blanket environmental protection provision. This is incorporated in the authority given to the Secretary of the Interior to prescribe rules and regulations to implement the Act; his authority to protect water quality and other environmental qualities is without limitation.

The Secretary used this authority to promulgate regulations which are also unique in the mineral development/environmental protection interface and to establish what the Department considers a pilot program of environmental control in the leasing of public lands. The regulations (Title 30 CFR Parts 270 and 271 and Title 43 Parts 3000 and 3200), and related special orders, called Geothermal Resources Operational Orders, for the first time applied to federal mineral lessees the full force of compliance with all applicable federal, state, and local environmental standards and any more stringent standards which the Geological Survey (USGS) Area Geothermal Supervisor of the lease may impose. This mandate includes control of all forms of air, land, water, and noise pollution, including but not limited to the control of erosion and the disposal of liquid, solid, and gaseous wastes.

These very specific and all-inclusive requirements offer a sharp contrast to the related language in the regulations which implement the Mineral Leasing Act of 1920 under which oil and gas lessees operate on federal lands (Title 43 CFR Part 3000). The latter regulations, written much earlier, set forth special stipulations to be attached to oil and gas leases which require a plan of operation which must include methods to be "used to assure the disposition of drilling mud, pollutants, and other debris." Environmentally acceptable methods of disposition are not mandated. The stipulations go on to require "all things reasonably necessary to prevent or reduce" to the fullest extent scarring and erosion of the land, pollution of water resources, and damage to the watershed. There is an apparent assumption that these things will nevertheless occur since the lessee is obligated to repair such damage and to take such corrective measures to prevent future occurrences as is deemed necessary by the Department. Other rudimentary restrictions are oriented almost exclusively to the protection of wildlife and no reference is made to air pollution, noise, or other ecological parameters.

It is understood that the Department will shortly make use of the environmental features developed for regulating geothermal operations as a model for other leasing programs, and that new oil and gas operational orders are being written which will narrow the dissimilarities in regulatory treatment of the two industries. The revised orders will support the efforts of the field oil and gas supervisors to attach environmental stipulations on a more localized basis.

In the meantime, individual potential geothermal lessees face from the outset a much more rigid, spelled-out set of environmental constraints. This situation is important in the context of relative competitive advantage among various forms of energy. It also prompts curiosity as to what the pace of oil and gas development might have been earlier in this century if each exploratory well drilled required an environmental assessment report and approval of a detailed plan of environmentally acceptable practices before a lease was issued, and, subsequently, an environmental analysis of every proposed action on the leased land. These are all routine requirements in the case of geothermal operations.

A number of people, including some in the Department of the Interior, stated to the contractor study team that they feel that the Geothermal Steam Act is a poor and hard to administer law and that the regulations are "loose." These documents are, nevertheless, milestones in the process of imposing compliance with broad environmental control requirements on the users of public lands. Efforts have been made in the Department to close gaps in the regulations through special orders which are discussed in Section IV.

## SINGLE-PURPOSE GEOTHERMAL STATUTES vis-a-vis AMENDMENT OF OTHER MINERAL LAW

The U.S. Congress, state legislatures, and county governing bodies had, or have today, the option of enacting new statutes tailored to the development of geothermal resources alone or extending the application of legislation designed to govern the exploitation of minerals, metals, oil and gas, or groundwater. It appears that the majority, including the Congress, have chosen the single-purpose legislative route. And, there is evidence that this is the more advantageous course if a jurisdiction wishes to broaden its environmental control authority at the same time.

The single-purpose legislative approach was not the original intent of Congress. The early geothermal legislation merely constituted an amendment to extend coverage of the Mineral Leasing Act. The effort to pass this amendment failed because of congressional-executive branch disputes over issues which were not related to environmental concerns. Finally, after debate spanning nearly a decade the amendment was rewritten as the Geothermal Steam Act which was enacted, bringing with it its own set of implementing regulations.

Thus, the separation of the geothermal provisions from those governing oil and gas leasing and production into single-purpose legislation was not motivated so far as is known by a desire to strengthen controls on misuse of the environment. However, this action appears to have had just that result, whether or not it was planned. The single-purpose legislation offered the opportunity to impose unlimited environmental regulation on a new, emerging industry which would have been much more difficult to apply to an entrenched industry. This is true both in terms of votes in Congress for restrictive environmental language and executive branch decisions in drafting the regulations.

The states which have legislatively addressed geothermal development have mostly enacted new statutes or comprehensive amendments which amount to the same thing. The motivation for the single-purpose approach has not been investigated as relevant to this study, and none is ascribed here. It is possible, however, that as a result of this approach, legislation again emerged with stronger environmental controls intact than would have survived had the legislature attempted to apply them across the board to strong industries covered by existing legislation.

The inference is fairly clear that environmental controls applicable to geothermal development will have smoother legislative sailing if they are written so as to avoid direct confrontation with other interests. It may be that this additional layer of environmental control will not be considered necessary in view of the existing interweave of legal environmental requirements at the federal, state, and local levels which apply to all sources of pollution. The mechanism is nevertheless there for those jurisdictions which choose to utilize it. And, before deciding that it is not needed, consideration as to whether existing regulations and standards designed to abate the pollution generated by dissimilar pollution sources are indeed applicable to the processes of this industry may be in order. This subject is addressed later in this section.

## LANDS AVAILABLE FOR DEVELOPMENT UNDER GEOTHERMAL ACT

On the surface of it, a discussion of which lands may be leased under the Geothermal Steam Act, those which may not, and those which qualify with additional agency approval does not appear germane to this study of environmental requirements. However, the source of the lease itself can indirectly affect what requirements are applied.

The following lands may be leased under the Geothermal Act and are subject to all of the requirements set forth and discussed in Section IV:

1. Public, withdrawn, or acquired lands administered by the Secretary of the Interior;

2. National forests and other lands administered by the Department of Agriculture through the Forest Service;

3. Reserved mineral lands of the U.S. (provided that geothermal resources are ruled to be a "mineral" in pending litigation).

Lands withdrawn or acquired for other purposes of the Department of Agriculture and lands subject to Section 24 of the Federal Power Act (16 USC 818) may be leased under the Act with the consent of the Department of Agriculture and the Federal Power Commission respectively. And, these agencies may prescribe their own set of terms and conditions. It is understood that the Department has attached stipulations dealing with matters such as fire control, for example, and the Commission is considering stipulations on siting of wells and roads in relationship to power lines, easements, etc.

Lands exempt from leasing under the Geothermal Act include national recreational areas, National Park Service lands, fish hatcheries administered by the Secretary of the Interior, wildlife refuges and ranges, game ranges, wildlife management areas, waterfowl protection areas, lands acquired or reserved for protection and conservation of fish and wildlife threatened with extinction, and Indian trust and restricted lands. The Act does not, however, preclude geothermal development in these areas under the authority of the controlling agencies. While no such development has occurred to date, it is assumed that either the lease applicant could demonstrate his ability to meet the most restrictive environmental requirements or a lease would not be issued. The same is also no doubt true of wilderness lands on which the Wilderness Act permits the development of power projects if the President determines this action is in the public interest.

On Indian lands, tribally or individually owned, the tribal council has the leasing and regulatory powers over geothermal development, with Bureau of Indian Affairs approval. The exemption of Indian lands has created a situation that begs the question of whether the Bureau of Indian Affairs is in compliance with the National Environmental Policy Act of 1969 (NEPA), 42 USC 4321, et seq., and thus can validly approve geothermal leases. BIA issued "Interim Guidelines" just before the Council on Environmental Quality's Guidelines (40 CFR 1500) were finalized in August of 1973. Although the BIA Guidelines (30 Bureau of Indian Affairs Manual Supplement I) state that BIA approval of a land or resource transaction is considered a "federal action" and thus susceptible to NEPA, BIA has never formally finalized its environmental guidelines. A BIA area office, in its evaluation of whether to prepare an environmental impact statement, can modify the "Interim Guidelines" if the Area Director warrants such a change is necessary. Therefore, if these modifications occur without compliance with the public notice requirements of Section 553 of the Administrative Procedures Act, 60 Stat. 237, 5 USC Sections 551-559, the validity of the modifications is questionable. All area offices contacted stated, however, that the U.S. Geological Survey's geothermal guidelines, federal pollution control statues, EPA regulations, and state and local environmental statues would be used for guidance. Regulations for BIA activity are found in Title 25 of the Code of Federal Regulations.

## OTHER FEDERAL GEOTHERMAL LEGISLATION

Three other federal laws were enacted in 1974 which touch upon the environmental control aspects of geothermal development although their overall scope is much broader. The first, and probably the most important from this standpoint, was the Geothermal Energy Research, Development, and Demonstration Act of 1974 (P.L. 93-410). This Act established a mechanism for federal funding of research into all facets of geothermal development including demonstration of technologies for production and use. Removal of institutional barriers to the use of geothermal resources as an energy source, dovetailing of environmental laws, and interagency cooperation are a few of the objectives of the Act.

The involvement, authority, and jurisdiction of various cognizant agencies were rearranged by the Energy Reorganization Act of 1974 (P.L. 93-438). This Act vested the primary responsibility for research and development of non-nuclear sources of energy in the Energy Research and Development Administration. Interagency cooperation for efficient use of alternative energy sources and minimization of environmental impact were again mandated. These goals were reiterated in the Federal Non-Nuclear Energy Research and Development Act of 1974 (P.L. 93-577). The Geothermal Steam Act remains dominant in terms of the authority of the Secretary of the Interior to regulate the environmental control practices of geothermal operations on federal lands.

## STATE AND LOCAL REQUIREMENTS

At least 14 states have adopted statutes governing the production of geothermal resources. These include Alaska, Arizona, California, Colorado, Hawaii, Idaho, Louisiana, Montana, Nevada, New Mexico, Oregon, Texas, Utah, and Washington. All of them which provide for leasing of lands for geothermal development apply, of course, only to state-owned lands. Others -- such as those dealing with resource conservation and regulation -- apply to all lands within the state. Statutes of Arizona, California, Colorado, New Mexico, Oregon, Texas, and Washington appear to fall in the latter category although some of these states also have a geothermal leasing statute.

Most of these states have adopted regulations implementing the geothermal statute, and some of them spell out very detailed environmentally-oriented requirements, although they generally stop short of numerical standards on pollution parameters, except in some cases, for noise and odors. The State of Wyoming has also promulgated geothermal regulations even though it has no statutes in this field. A few geothermal ordinances have also been adopted at the county level. These include several in California and Nevada, one in Oregon and Utah, and possibly others.

The states have, to a large extent, patterned their geothermal statutes very much after those related to oil and gas. It is reported that this fact has been the subject of controversy in California in terms of its effect on drilling requirements. One faction supports the view that downhole drilling techniques are roughly the same regardless of the resource produced, and the other points to the variations in tools and technologies required for geothermal production. The expressed California state view is that up to now the industry has operated under the law and as experience reveals "clinkers" in it, it can be rewritten as needed.

The number of regulations reviewed in this survey which spell out specific drilling requirements is limited, but those which do so appear to apply the same procedures which are accepted practices in the oil and gas industry. This no doubt results from the fact that there is insufficient experience with geothermal production to offer a basis for differentiation. No official documents have been reviewed which undertake to equate the production techniques or related pollution control requirements of the geothermal industry to exploitation of groundwater or minerals other than oil and gas.

## GENERAL ENVIRONMENTAL CONTROL REQUIREMENTS

In addition to those dealing specifically with geothermal development, there are federal, state, and county laws and regulations which are generally applicable to all sources of pollution or potential sources. None have been reviewed which specifically exempt geothermal production or use from their requirements so the conclusion is drawn that they will apply to such operations. Some of the geothermal regulations specifically reference the air, water, noise, or other environmental standards with which compliance is required, and others simply require blanket compliance with all applicable standards. Reference to geothermal wastes, as such, in the general environmental control documents is, as yet, rare.

## DEFINITION OF GEOTHERMAL RESOURCES

There has been considerable discussion and litigation in both federal and state courts on the definition of geothermal resources. However, whether they are defined as a mineral, water, or a unique resource is only of peripheral interest to this study. The major impact of the definition on environmental control is that if it affects ownership of the resource, it will in turn determine which agency has jurisdiction and whether federal or state regulations apply. Since both federal and state environmental requirements are covered in this report, the subject of definition will not be dealt with.

## APPLICATION OF FISH AND WILDLIFE COORDINATION ACT

A definition of geothermal resources as water could, however, invoke application of the Fish and Wildlife Coordination Act (16 USC, Section 662). While the Geothermal Act and regulations, the National Environmental Policy Act, and various state environmental impact evaluation procedures require conservation of wildlife, the protective requirements of the Coordination Act are much more stringent and far-reaching. It requires baseline studies of the environment of areas to be leased and the establishment of measures to mitigate harm prior to leasing. The Fish and Wildlife Service could oppose a proposed geothermal plan of operation if full consideration were not given. The Service reviews all federal and federally-related applications that affect territorial and inland navigable waters and wetlands. The review process is initiated.

> "whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose whatever."

If geothermal resources are held to be water-dependent, the Service could issue guidelines analogous to the December 1975 "Oil and Gas Exploration and Development Activities in Territorial and Inland Navigable Waters and Wetlands" (40 Fed. Reg. 55804).

The USGS geothermal regulations require the lessee to take measures for conservation of endangered and threatened species of flora and fauna as set forth in applicable executive orders, regulations, and state and federal legislation such as the Endangered Species Act of 1973 and the Fish and Wildlife Coordination Act. Since the Fish and Wildlife Coordination Act applies only to water-dependent projects, resolution is necessary as to whether the incorporation of the Coordination Act is valid.

## ENDANGERED SPECIES ACT OF 1973

This act (P.L. 93-205) is designed to prevent the future decline, and to bring about the restoration of, endangered and threatened species of fish, wildlife, or plants. It requires the Secretary of Commerce and the Secretary of Interior to develop and maintain a list of species determined to fall within these categories. Certain provisions of the Act and their interpretation and implementation by the Fish and Wildlife Service and the National Marine Fisheries Service could potentially impact geothermal development, either on public or private land.

A major purpose of P.L. 93-205 is "to provide a means whereby the ecosystems upon which endangered species and threatend species depend may be conserved." The primary thrust of the above agencies' implementation of this is the designation of critical habitats, which may consist of an entire habitat or any portion of one. The definition of "critical habitat" may be found in the Federal Register of April 22, 1975. The designation of such areas does not automatically preclude specific activities within them "unless such actions actually could be considered detrimental to the species involved" (Federal Register, July 14, 1976). In fact, the 1975 publication of the critical habitat concept specifically emphasizes that certain actions may not be detrimental and that there may be many kinds of actions which could be carried out that would not be expected to result in the reduction of the numbers or distribution of the species or otherwise adversely affect it.

However, this statement must be viewed in relationship to the agencies' interpretation of the term "taking" as used in the Act. It is employed in the context that the taking of an endangered species is prohibited, except for limited specified purposes. In an amendment to Part 17 CFR (Federal Register, September 26, 1975), the definition of "take" embraces "harm" which is defined as "an act or omission which actually injures or kills wildlife, including acts which annoy it to such an extent as to significantly disrupt essential behavioral patterns, which include, but are not limited to, breeding, feeding, or sheltering; significant environmental modification or degradation which has such effects is included within the meaning of 'harm.'"

In this definition, potential restrictions on environmental modifications are expressly limited to those actions causing death or injury to a protected species of fish or wildlife. The actual consequences of such an action upon listed species is, according to the Fish and Wildlife Service, paramount.

However, in the Federal Register discussion (April 22, 1975) of the critical habitat concept, it is pointed out that federal conservation actions involving critical habitats may include the development of regulations, management plans, and other rather open-ended actions. Thus, if a promising area for geothermal production and use in a power plant, for example, coincides with a designated critical habitat, it appears possible, if not probable that potential consequences could become an issue in obtaining the necessary exploration and production permits, as opposed to actual consequences.

This is certainly the case with geothermal development on federal leases, in any event. Section 7 of the Act requires all federal departments and agencies to avoid actions authorized, funded, or carried out by them from destroying or adversely modifying critical habitats. This, of course, is the basis for tying the requirements of the Endangered Species Act into the federal geothermal regulations, as noted above.

# SECTION III

# ANALYSIS OF FEDERAL/STATE POLLUTION CONTROL REQUIREMENTS

The major thrust of this section is the uncertainty which surrounds the environmental control requirements with which the emerging geothermal industry will be called upon to comply. It points up the sparsity of existing numerical standards which relate to the anticipated waste parameters of geothermal operations. Section V in turn raises the further question of whether, indeed, some of the existing numerical limitations are suitable for application to geothermal operations which involve neither combustion nor materials other than water or steam and associated pollutants. These questions will be addressed again when all the results of Phase II of the project are in.

As discussed previously, geothermal operations on federal land are subject to compliance with all applicable federal, state, and local environmental control standards dealing with air, land, water, and noise. The word "standards" is interpreted here to mean all applicable statutes and regulations. Specific standards on various parameters are, of course, the heart of environmental regulations and the form of regulation in this field which is most easily enforced.

Geothermal operations on state and private lands are also subject to federal, state, and local standards. This is because general, across-the-board pollution control regulations apply to all sources or potential sources of pollution whether or not states specifically reference the standards in geothermal statutes or regulations.

This section of the report analyzes federal pollution control requirements and state requirements which are necessitated by federal legislation. It also presents general discussions of land disposal, noise, erosion control, and subsidence regulation at the federal and/or state level although interplay between the two levels in these areas is not specifically mandated.

In many cases, the state air and water pollution control documents do not go much further than the performance required of them by federal law. This section deals only with the broad interaction between the two levels in these areas; specific state standards are discussed in Section V.

## AIR POLLUTION CONTROL

The primary, if indirect, objective of the federal Clean Air Act, as amended in 1970, is the imposition of limitations on the emissions of air pollutants from both stationary and mobile sources. This discussion is limited to stationary sources only.

The mechanisms prescribed in the Act for establishing emission limitations are set in motion at the federal level. However, with only a few exceptions the numerical emission standards are set by the states.

### Air Quality Criteria/Ambient Air Quality Standards/State Emission Standards

The first procedure outlined in the Act with the ultimate objective of emission standards begins with the issuance of air quality criteria on pollutants which in the judgment of the EPA Administrator have an adverse effect on public health and welfare. The criteria undertake to identify scientifically the kind and extent of all effects on health or welfare which may be expected from the presence of a given pollutant in the ambient air, in varying quantities, and under various conditions.

The Administrator is then directed to promulgate both a national primary and secondary ambient air quality standard for the pollutant. Primary standards are geared to protect public health and secondary standards are designed to protect public welfare. ("Welfare" is interpreted to mean effects on soils, water, vegetation, materials, economic values, and personal well-being, among others.)

Ambient air standards are goals for what is considered acceptable air quality in a given area. They are designed to reflect the causative relationship between the level and degree of pollution and the degree of its effects, and, in some cases, a time element.

Emission standards limit the allowable amount of pollutants which may legally enter the atmosphere from a given source. They are calculated at levels which theoretically will permit the ambient air standards to be achieved, taking into account air quality and meteorological considerations. This statement is too simplistic where a density of sources is involved, but this is not expected to be a problem in geothermal production. Emission standards are enforceable whereas ambient air standards usually are not -- they are only objectives, as stated above -- and emission limitations are the primary regulatory control tool of interest to the emerging geothermal industry.

Once an ambient air standard is set, the Clean Air Act requires the states to adopt a plan to implement the standard. This plan must include an emission standard for the pollutant.

### Federal Emission Standards

However, the Act requires EPA itself to establish three major types of emission standards. These standards include: (1) new source performance standards (NSPS); (2) national emission standards for hazardous pollutants; and (3) emission standards imposed by EPA when a state fails to adopt its own emission standards or its standards are deemed inadequate.

The first of these is the only one likely to be of major concern to geothermal operations. This is true first because, based on what is known today about the probable air pollutants associated with geothermal production and their concentrations, this type of activity will not be a source of "hazardous" pollutants in the context of the Act. "Hazardous" pollutant is defined as one which in the judgment of the EPA Administrator may cause, or contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness. It is not anticipated that levels of hydrogen sulfide present in geothermal deposits will meet this criterion although topographic and meteorological conditions could possibly engender hazardous levels sporadically in some cases.

Second, any emission standards imposed by EPA in the absence of state action would probably fall within the numerical limitations adopted by other states and approved by EPA. Thus, no requirements substantially different from those of neighboring states would be expected through this route.

The new source standards of performance are emission standards in the sense that they impose restrictions on quantities of pollutant emissions. However, they are different in character from other emission standards in that they are designed primarily to reflect the best demonstrated technology taking costs into account, and, contrary to the purposes of other emission limitations, are not calculated to achieve any specific air quality levels. Once an NSPS is established for a pollutant for which no air quality criteria have been issued, Section 111 of the Clean Air Act requires the states to set emission standards for such a pollutant. This emission standard will be applicable to existing sources of the pollutant of the same type as the new sources designated in the NSPS. These standards are not required to be more stringent than the NSPS, but since the states are not preempted from more stringent regulations on stationary sources, this possibility always exists. Thus, when, or if, EPA establishes NSPS applicable to geothermal wells and attendant activities, this action will not only affect all future geothermal development, but will affect existing operations as well, potentially more so.

## State Emission Standards vis-a-vis NSPS

It appears currently that the importance of the functions of Section 111 will increase significantly for all sources of air pollutants and especially for geothermal operations. The explanation for this lies both in past EPA actions and predictions for its future course.

Criteria and ambient air standards have been issued on only six pollutants: sulfur dioxide, particulates, carbon monoxide, photochemical oxidants, hydrocarbons, and nitrogen oxides. Applicability of the $NO_x$ ambient air standard based on the criteria has subsequently been greatly reduced since it was discovered that some of the criteria were generated through faulty monitoring methodology. Thus, in actuality, no ambient air standard in general use is based on criteria issued since the Act was passed, although the EPA Administrator was recently ordered by the courts to publish criteria on lead.

This background suggests, and discussions with EPA personnel tend to confirm, that the federal criteria/ambient air standard/state emission standard mechanism will not play a significant role in the future. It is anticipated that use of the Section 111 procedure will instead increase in predominance--i.e., that state emission standards for various pollutants from existing sources will result from the application of federal new source performance standards. This prediction is also supported by the fact that the Administrator's reason for not issuing criteria and standards for lead is that he had determined to control lead emissions through the fuel additive section of the Act and Section 111, the route he will follow if the court order is withdrawn.

The timing of EPA action on an NSPS geared to geothermal production and use will almost certainly depend on how soon this industrial activity becomes a potential major source of air pollutants, the nature of the pollutants generated, degree of overt public concern, and EPA's backlog in promulgating standards of performance. In view of the fact that NSPS have not yet been established for such widely recognized sources as petroleum refineries, iron and steel mills, gray iron foundries, lead battery manufacture, and a number of others, geothermal wells would have to be granted very high priority to top this list in early attention.

## Problems in Establishing NSPS for Geothermal Operations

The backlog exists largely because the selection of standards of performance to achieve the intent of Congress has been surprisingly difficult, according to EPA reports, and due to the limited geothermal experience, the task is likely to be even more difficult for this source. In general, the standards must: (1) realistically reflect best demonstrated control practice and consider the cost of such control; (2) apply to modified existing sources as well as new installations; and (3) meet these conditions for all variations of operating conditions under consideration anywhere in the country. In light of the very wide variation in the nature of geothermal resources, the latter criterion is formidable at best.

A major step in developing NSPS is identification of the best system of emission reduction which "has been adequately demonstrated" and quantifying the emission rates achievable with the system. EPA interprets the legislative history of Section 111 and various court decisions to mean that the Administrator's judgment of what is adequately demonstrated is not limited to systems that are in actual routine use. Consequently, he may consider control systems which have been adequately demonstrated but for which there is limited operational experience. To date, the Agency has based its determination of the "degree of emission limitation achievable" primarily on results of tests of emissions from existing sources. In some cases, this has required investigation of emissions from control systems in other countries where more effective systems of control than those in the United States are employed. This is also a likely circumstance when attention is focused on geothermal production.

When the best demonstrated systems of emission reduction are not in widespread use, the data base upon which the standards are established will necessarily be somewhat limited. This is certain to be a problem with geothermal production and use, and EPA's common starting point -- test data on existing well-controlled sources -- is likely to be limited as well, especially in view of the wide variation in geothermal formations, as noted above, and production techniques. Since the control of existing wells will represent retrofit technology in most cases or technology designed to meet an existing state or local regulation, EPA may decide that new wells can meet more stringent emission limitations.

## Significant Deterioration Regulations

Another route to federal/state control of air pollution emissions which could be made applicable to geothermal operations are the regulations designed to prevent significant air quality deterioration in areas of states where the air pollution levels are currently below the national ambient air quality standards. These regulations are source-specific and do not presently cover geothermal operations, although it is understood that consideration was given to their inclusion. By virtue of the more remote locations of geothermal resources in the preponderance of cases, it would not be surprising if this decision were reversed at some future time.

And, unless Congress clarifies all of the ambiguities presently surrounding this issue, and the issue is currently pending in amendments to the Clean Air Act, this encounter could invoke a strong restraining influence on geothermal development in some areas. In fact, EPA, in its Federal Register statement on the regulations noted that a policy of preventing significant deterioration "will have a substantial impact on the nature, extent, and duration of future industrial development . . . throughout the United States . . . (which) could affect the utilization of the Nation's mineral resources . . ." The concept is a highly emotional issue which is apt to remain so until there are binding determinations of the definition of "significant deterioration" and exactly how it will be prevented.

The genesis of the conflict is that the Clean Air Act declares that one of its purposes is "to protect (emphasis added) and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." However, nowhere in the sections dealing with standards and implementation plans is there any guidance on protection of pristine air. Thus, EPA interpreted the Act to mean that it must approve state implementation plans which will attain and maintain the national ambient air quality standards, and that the Act does not require EPA or the states to prevent significant deterioration of air quality.

However, environmental groups and some states used the above language and the legislative history of the Act to achieve a court injunction requiring the Administrator to disapprove any portion of a state plan which does not effectively prevent significant deterioration. This was upheld by the Supreme Court by an equally divided vote. The details of this judicial record may be found in the Federal Register of July 16, 1973.

The regulations subsequently promulgated as Section 52.21 of Title 40, CFR, are summarized as follows:

The regulations are applicable only to those counties, other functionally equivalent areas, lands owned by the federal government, or Indian lands in which air quality did not exceed national ambient air standards for sulfur dioxide or particulate matter in 1974. In areas designated as Class I and Class II, a maximum percentage of increase in concentrations of these two pollutants would be imposed; Class II is much more permissive. In areas designated as Class III, the levels would be restricted to those of the national ambient air quality standards. All areas were initially designated as Class II, and redesignation to the stricter Class I or more lenient Class III is dependent upon requests by states, federal land managers, and Indian governing bodies which, after hearing, are approved by the EPA administrator. No applications for reclassifications have been received by EPA.

The types of new or modified sources of sulfur dioxide and particulates which are specifically subject to very stringent construction permit requirements do not include operations which can be compared directly to geothermal production or use. However, there is evidently nothing to prevent geothermal activities from being added if it is determined that they would contribute to levels of $SO_2$ or particulates which exceed those permitted for the class of area in which they are to be located.

The State of Colorado has already applied a similar concept and it is understood that Montana is considering such action.

## WATER POLLUTION CONTROL

The prevailing legislative control of water pollution is the Federal Water Pollution Control Act as it was amended in 1972 (P.L. 92-500). This 89-page law and the hundreds of pages of new regulations it engendered will impact upon almost any type of industrial activity, but its effects are, of course, more pronounced on the industries whose processes require the use of large volumes of water. The degree of its effects on geothermal enterprises will almost certainly vary with the form in which geothermal resources are manifested, the production technology utilized, the use to which the resource is put, whether and under what conditions reinjection of geothermal fluids is permitted, and to what extent reinjection is deemed a more attractive alternative than discharge to surface waters.

It is emphasized here that all of the ensuing discussions of provisions of P.L. 92-500 are relevant only to surface discharge of pollutants. "Pollutant," by definition, does not mean "water derived in association with oil or gas production and disposed of in a well, if the well used . . . for disposal purposes is approved by authority of the state in which the well is located, and if such state determines that such . . . disposal will not result in the degradation of ground or surface water resources." While this now specifically applies only to oil and gas operations, it provides a vehicle which could be extended to related geothermal activity. In areas where methane comprises a large percent of the total volume of geothermal deposits, an interpretation would be needed as to its present applicability.

It will be noted that the new state underground injection control program discussed below is proposed by EPA pursuant to the Safe Drinking Water Act rather than the Water Pollution Control Act.

As discussed above, the latter Act requires interaction between the federal program and the states, although the mechanisms prescribed are some what different from those of the Clean Air Act. In one important area, implementation of the National Pollutant Discharge Elimination System (NPDES) permit program, state participation is voluntary. They are not required to manage this program under state law unless they desire to do so.

The states which have qualified to implement the NPDES program within their borders include several with geothermal deposits such as California, Colorado, Hawaii, Montana, Nevada, Oregon, Washington, and Wyoming. More current information on the status of a given state in this regard may be ascertained through a state or local water pollution control agency.

All of the many ramifications of the Act and the regulations are not presented separately here. Instead, the potential broad, cumulative effect on geothermal development is analyzed.

## Effluent Limitations and Standards

In those industries where effluent guidelines have been established for meeting the 1977 and 1983 requirements of the Act, described below, there is probably less uncertainty in this regulatory arena than in air pollution control -- or there will be when the guidelines in litigation are resolved. However, while geothermal operations received some attention by the EPA contractor who performed the guideline study of steam supply and non-contact cooling water in 1974, no recommendations were made for effluent limitations and standards [1]. In addition, it is felt unofficially at EPA that while generation of electric power with geothermal steam was not specifically exempt from the limitations guidelines which apply to the thermal effluents of fossil fuel and nuclear power plants, they are not applicable. There is presently no plan to develop this type of regulation for the geothermal industry.

This situation is, of course, subject to change. The mechanism which EPA would probably utilize is to add geothermal production and/or use to the list of source categories required by the Act. Entry on the list automatically requires that new source performance standards be set for the source category within a year. In actual practice, announcement of the addition of the category is simultaneous with the publication of NSPS, along with guidelines for 1977 and 1983 effluent limitations. Since this action would be preceded by a study of several months' duration, the geothermal industry would have considerable advance notice.

The 1977 effluent limitations require the application of the best practicable control technology (BPCTCA); by July 1, 1983, the best available technology economically achievable (BATEA) must be applied. New sources must achieve standards of performance which reflect the greatest degree of effluent reduction achievable through the application of the best demonstrated technology, processes, operating methods, or other alternatives.

The actual limitations and standards are promulgated as single-value limitations on permissible discharges of specific constituents. The technologies and alternatives are defined on an industry-by-industry basis in guidelines which accompany the limitations. It has been argued, unsuccessfully so far, that issuance of the guidelines is the only power which the Act confers on the Administrator over effluent quality applicable nationwide -- i.e., that the binding single-number effluent limitations for existing point sources can only be established by the permit-granting authorities (principally the states) who are to utilize the guidelines in the process. The 3rd Circuit U.S. Court of Appeals found, however, that in spite of the lack of clarity in the Act on this point, the Administrator's power to promulgate numerical effluent limitations under Section 301 of the Act can be inferred [2].

Many of the effluent limitations promulgated have been contested in court by the affected industries, primarily on a point which will be highly significant when EPA undertakes to set limitations for geothermal production and use. The contention has been that an inadequate wastewater treatment performance data base was utilized to arrive at the numerical standards, and that they are thus not representative of or achievable by all sources in a category. While this situation existed in some established industries because of the limited number of treatment systems utilized to produce any data, it will occur in the geothermal industry because the number of operations themselves is limited, and, up to now, there is virtually no wastewater treatment to provide data. EPA has attempted to overcome this deficiency with the transfer of treatment technologies from related industries with similar waste characteristics. This practice, too, has been the subject of considerable controversy.

Until effluent guidelines are promulgated for the geothermal industry, their absence will be a significant factor in the NPDES permits for the discharges of these operations.

### NPDES Permits

Under P.L. 92-500, pollutant discharges into the navigable waters of the country, the territorial sea, the waters of the contiguous zone, or the oceans without an NPDES permit are illegal with limited exceptions. The exception of particular interest to the geothermal industry is the one quoted above exempting injection of water derived in association with oil or gas products. This exclusion of injection from the requirements of the permit system is particularly noteworthy because the system's application is by definition limited to surface waters only. (A relationship is again drawn between underground injection and oil and gas operations in the Safe Drinking Water Act and in recently proposed EPA regulations pursuant to the Act. These regulations are discussed below.)

Industrial wastes discharged to publicly owned treatment systems are also exempt from NPDES provided that they are in compliance with pretreatment standards. Again, no such federal standards have been set for the liquid wastes of geothermal production or use.

In the absence of federal effluent limitations and new source performance standards, a permit for discharging geothermal wastes is likely to be conditioned on state standards. These are water quality standards consisting of water quality criteria and a plan for their implementation. They limit the concentrations of pollutants present in waters receiving discharges to a numerical value in terms of parts per million or milligrams per liter. However, EPA has adopted a pounds-per-unit-of-production value on most parameters in industrial wastes for use in effluent limitations, as opposed to water quality standards. The newer concept equalizes the limitations among all sources in a category of sources, regardless of size.

Thus, in determining the conditions of a geothermal discharge permit, the water quality standard would be translated into a pounds-per-unit-of-production limitation on effluent parameters which would maintain the required receiving water quality. In some cases, this process may result in stricter effluent limitations than EPA would find necessary to apply to the whole industry. This is because the states are permitted to set more stringent standards, and they do so for bodies of water where they feel it is desirable. The actual limitations on pollutant parameters in the permit are usually expressed in pounds per day.

A copy of a federal permit application is shown in Appendix A to illustrate the kind of information which must be supplied.

Permits issued by states are exemplified by the permit which the State of California issued to Union Oil Co. of California for waste discharges at The Geysers, the only geothermal field presently used for electric power generation in this country. It is shown in Appendix B. The permit is entitled "Waste Discharge Requirements," the terminology used by the state in its Water Quality Control Act which is synonymous with the federal term "permit." (This Act is summarized in Section V.)

The discharge specifications of the permit: (1) prohibit the discharge of wastes of any nature to the waters of the nearby creek or its tributaries; (2) require the disposal of drilling muds, oils, and associated wastewater on a disposal site approved and classified by the regional water pollution control board; and (3) prohibit nuisance and pollution created by the treatment or disposal of waste. In addition, the permit provides that: (1) wastes produced in connection with site preparation and road construction will be placed where they cannot be reasonably expected to be carried to the creek or its tributaries; (2) all roads and exposed surfaces will be protected from erosion; and (3) the company will comply with a notification, monitoring, and reporting program. The Notification, Monitoring, and Reporting Program is shown in Appendix C. Such programs are authorized in the federal NPDES permit regulations, Title 40 CFR, Part 125.

An important amendment was added to the NPDES regulations last year (Section 125.28, Title 40 CFR). The effect of this is that under certain circumstances, a discharger is credited for the pollutants which are present in his intake waters and are not removed through the application of the required level of technology. He is thus responsible for removing only those pollutants added in his operation. At present, the required level of technology for a geothermal operator is the conditions of his NPDES permit. For this rule to apply, the discharge must be made into the same body of water from which the water supply came. There are other stipulations but it appears that this credit could be achieved if doing so were really important to the discharger.

## Environmental Impact Statements for New Source NPDES Permits

Section 511 of the Water Pollution Control Act applies the provisions of the National Environmental Policy Act of 1969 to the issuance of an NPDES permit for a new source of water pollution. However, the Act defines a new source as one on which construction is commenced after applicable new source performance standards are proposed. Thus, in the absence of such standards geothermal operations are not yet subject to the federal regulations implementing this provision of the Act proposed last year (40 CFR Part 6). However, their requirements will constitute a rather difficult environmental restraint on a young industry consisting almost entirely of new sources when or if EPA proposes new source performance standards for its operations. Thus, a brief description is included here.

These regulations, which have not yet been finalized, will be applicable only to new source permits issued by EPA and not to permits obtained under state programs. The Act does not specifically apply Section 511 to state-issued permits, and not all states which have been granted NPDES authority have a state statute commensurate with NEPA. Whether application of Section 511 to state permits can be inferred is beyond the scope of this project, but since the states are rapidly enacting NEPA-type statutes on their own, it probably is not an overriding consideration in any event.

The whole federal procedure hinges on the initial decision as to whether a proposed facility is a "new source." The guidelines provided to Regional EPA Administrators for this purpose are as follows:

A source should be considered a new source provided that at the time of proposal of the applicable new source standard of performance, there has not been any:

"1. Significant site preparation work, such as major clearing or excavation; or

"2. Placement, assembly, or installation of unique facilities or equipment at the premises where such facilities or equipment will be used; or

"3. Contractual obligation to purchase such unique facilities or equipment. Facilities and equipment shall include only the major items listed below, provided that the value of such items represents a substantial commitment to construct the facility:

- a. structures; or
- b. structural materials; or
- c. machinery; or
- d. process equipment.

"4. Contractual obligation with a firm to design, engineer and erect a completed facility (i.e., a 'turnkey' plant)."

If normal prudence is exercised in obtaining all applicable approvals, permits, licenses, etc., before committing funds to advanced development work, then under these guidelines nearly all future geothermal operations would be defined as new sources when they become subject to NSPS. In addition, existing state environmental impact reporting requirements do not generally limit their application to "new sources," but apply them across the board to actions which will significantly affect the environment.

Thus, it appears that most, if not all, proposed geothermal development may be subject either now or at some future point to NEPA-type scrutiny at the federal or state level. This discussion is limited to the proposed federal regulations (40 CFR Part 6), and the state requirements are summarized in Section V.

In brief the steps to be followed are:

1. Potential new source applicant executes a new source and environmental questionnaire (NS/EQ).

2. The completed form is filed at least nine months prior to construction of the facility. (It is pointed out that it is to the applicant's advantage to return the form as early as possible so that if an environmental review is deemed necessary, construction will not be held up.)

3. The Regional Administrator decides whether the facility is an existing or new source.

4. If it is a new source, applicant submits an environmental assessment unless the Regional Administrator determines that the NS/EQ is adequate.

5. An adjudicatory hearing is held on new source decision if requested by the applicant or an interested party.

6. The Regional Administrator conducts an environmental review to determine whether an environmental impact statement is required. (The guidelines he is to use are shown in Appendix D. It appears that several of the criteria listed could be interpreted to necessitate an EIS on proposed geothermal development.)

7. If an EIS is not required, a negative declaration is issued.

8. If an EIS is required, the Regional Administrator then "assures" that a draft EIS is prepared. (There is nothing to indicate who will prepare the EIS.)

9. The availability of the draft EIS is published in the Federal Register and a public hearing is convened if there is a significant degree of public interest.

10. The Regional Administrator prepares a final EIS.

11. The Regional Administrator approves or denies the permit.

This brief description covers only the highlights of the procedure. The detailed content of an EIS as prescribed by the regulations is shown in Appendix E.

In addition, there are other legal provisions to be considered. These include the requirements of the National Historic Preservation Act of 1966, the Archaeological and Historical Preservation Act of 1974, Coastal Zone Management Act of 1972, Wild and Scenic Rivers Act, Endangered Species Act, and others, along with implementing regulations.

## Proposed Toxic Effluent Standards

P.L. 92-500 requires the Administrator to establish effluent standards (or prohibitions) for toxic pollutants taking into account their toxicity, degradability, the importance of organisms affected, and other factors. The toxic effluent standards will be applicable only to designated categories of sources and none have yet been prepared which are directed to geothermal operations. Nor are geothermal operations on the list of industries to which EPA has agreed to establish toxic effluent limitations and standards for achievement by June 30, 1983 [3]. It is possible that use of geothermal steam to generate electric power could be included in the steam electric power plants category, but as discussed above, this was not done in establishing effluent limitations and standards for other than toxic pollutants for this point source. There is nothing presently to suggest a change in procedure.

However, EPA has agreed [3] to publish maximum permissible concentrations in waterways for each of 65 toxic pollutants by June 30, 1978. These water quality criteria are to be used as guidelines by state and federal authorities in issuing NPDES permits to regulate discharges from individual plants to insure that concentrations of a given pollutant(s) in the receiving water do not exceed safe levels. It is probable that this general mechanism will affect geothermal waste discharges long before any industry-specific toxic effluent standards are set.

The listed pollutants which might be found in geothermal deposits in this country according to current knowledge of their character are:

Arsenic and compounds
Beryllium and compounds
Cadmium and compounds
Copper and compounds
Lead and compounds
Mercury and compounds
Nickel and compounds
Zinc and compounds

However, it is very possible that the naturally-occurring concentrations of these substances would not reach the harmful threshold. This subject will be addressed in the Phase II report on this study.

One other listed class of pollutant -- chromium and compounds -- is likely to be found in some drilling muds used in geothermal drilling. However, as a waste, this material would be subject to land disposal regulation rather than surface water discharge limitations.

When promulgated, a toxic pollutant standard or prohibition will prevail over any limitation in an NPDES permit for the same pollutant which is less stringent than the standard, and takes effect immediately.

## Thermal Standards

Because of inherent inefficiencies in the generation of thermal power from steam, it is necessary to dispose of large amounts of waste heat. The process efficiency is a function of the steam temperature. Fossil-fueled steam generation plants operating at high steam pressures and temperatures can achieve about 40 percent efficiency. Present nuclear plants cannot operate at such high temperatures so their efficiency is commonly in the lower 30 percent range. In geothermal plants, with still lower steam temperatures and consequently lower efficiencies, the required disposal of waste heat will be even greater. A similar problem may also occur in other uses of geothermal resources such as space heating, depending, of course, on the particular process involved.

Effluent limitations guidelines and standards contain restrictions, where applicable, on the temperature of discharge wastewaters in addition to the limitations on chemical parameters. In the absence of such standards for the production of geothermal resources, the thermal discharge limitations will be based on state water quality standards through the NPDES permit program.

The thermal water quality standards for various states are given in Section V. In general, the limitation of temperature rise above normal is a function of the type of fishery desired in the water body. When the standards require that the waters should be suitable for at least a warm water fishery, maximum temperature rises 2.8°C (5.0°F) above ambient are prescribed. In some cases, maximum absolute discharge temperatures are also set for the water body. Where it has been judged that the water would be suitable for cold water fish, such as trout and salmon, the allowable temperature rise and absolute temperature are often more restrictive. In some of the northern states surveyed, where all waters are cooler, the more stringent limitations are applied statewide. In others, the degree of temperature rise limitation depends on the normal temperature of a given water.

The same NPDES/state standard procedure for establishing thermal discharge requirements is almost certainly as applicable today to the use of geothermal resources as well as to their production. However, for specific applications of the geothermal product, it is possible that the thermal effluent guidelines and standards established for the industry in which the product is used may be applicable. The thermal guidelines and standards set for the steam electric power generating industry [4] are a good example. While these restrictions were developed primarily for plants where the steam is generated by fossil fuel or nuclear power, the promulgated regulations do not specifically exclude generating plants operating on geothermal steam. And, they could theoretically be interpreted to include plants where the steam is of geothermal origin since the means used to generate the steam has no effect on the disposal of waste heat. However, as noted previously, discussions with the EPA group which developed the steam electric industry guidelines indicate that while such an interpretation is possible, it is not likely on the basis that geothermal operations were not characterized in the regulations.

If such an interpretation should prevail, these limitations would require that all units of greater than 25 MW capacity placed in service after January 1, 1974, discharge no heat to navigable waters except blowdown from a closed-cycle cooling system cold side, subject to the provision of Section 316(a) of P.L 92-500.

Recognizing that the installation of cooling towers or a cooling pond, as would be required by these limitations, is not always cost effective, Congress included this section which reads as follows:

> "Thermal Discharges - Sec. 316(a) With respect to any point source otherwise subject to the provisions of section 301 or section 306 of this Act, whenever the owner or operator of any such source, after opportunity for public hearing, can demonstrate to the satisfaction of the Administrator (or, if appropriate, the State) that any effluent limitation proposed for the control of the thermal component of any discharge from such source will require effluent limitations more stringent than necessary to assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water into which the discharge is to be made, the Administrator (or, if appropriate, the State) may impose an effluent limitation under such sections for such plant, with respect to the thermal component of such discharge (taking into account the interaction of such thermal component with other pollutants), that will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water."

In essence, Section 316(a) allows for a variance from thermal standards when it can be shown that the introduction of a given amount of heat into the receiving body of water will not interfere with the "protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water." The federal EPA and the various states which have received permit authority have set up detailed procedures dealing with obtaining such alternate effluent limitations, both for existing and proposed new units. For new units these procedures require a study to determine the present indigenous populations, a determination of how the temperature in the water body will be altered by the proposed discharge, and finally a determination based on the literature or new studies of how the new temperature would affect the indigenous population. In general, such a demonstration may require thermal modeling and ecological studies which include several seasons followed by a definitive report, and various public hearing and review procedures. Depending on the physical plant setup, the water body involved, and the state and federal regulatory agencies, a considerable amount of time often elapses before a determination can be made under Section 316(a). Proposed guidelines have been issued for 316(a) studies [5].

In a great many areas where geothermal resources may be used to produce electric power, there will not be a sufficiently large body of water available to accommodate the thermal discharges associated with the use of once-through cooling water for the condenser, and dissipation of heat by cooling towers will be necessary. However, in considering sites for location of geothermal power plants it should be kept in mind that a water supply permitting the use of once-through cooling via the 316(a) route will have definite economic benefits.

Another factor which must be considered when discussing the use of local water for once-through cooling is the intake structure. Section 316(b) of P.L. 92-500 requires that such facilities use the best available technology to minimize the effects of impingement and entrainment of the fish and other elements of the aqueous food chain. In general, NPDES permits for such structures require that information be submitted proving that such effects are minimal.

In summary, limitations on the thermal component will apply to any discharge of waters from geothermal resource utilization. Because of the lower temperatures of operation, and, hence, lower efficiencies of geothermal installations, such installations will normally reject a larger fraction of their total heat to waste than similar installations using fossil fuel or nuclear power. The need to dissipate this waste heat to the atmosphere or elsewhere, rather than to a local body of water, may act to limit geothermal development because of increased costs, but will not be an absolute bar since alternate methods of heat dissipation are readily available in the form of wet or dry cooling towers or cooling ponds.

## UNDERGROUND INJECTION CONTROL

The Safe Drinking Water Act (P.L. 93-523) mandated the establishment of minimum requirements for effective state programs designed to protect present or potential underground drinking water supplies from contamination through subsurface injection of fluids. EPA has proposed regulations for this purpose as 40 CFR Part 146 (Federal Register, Aug. 31, 1976).

The states are given primary enforcement authority and the regulations are designed to allow states flexibility in coping with differences among them in geological conditions, use and availability of groundwater, and intensity of subsurface injection activities. However, the basic health standards to be applied are uniform for the whole country.

The Act defines "endangerment" as the presence of a contaminant which "may result in (a public water) system's not complying with any national primary drinking water regulation or may otherwise adversely affect the health of persons." In the case of an existing system using an underground water source, the logical meaning of this provision, EPA said, "is that contamination endangers drinking water if it requires the use of new or additional treatment by the system to meet a national primary drinking water regulation or otherwise to prevent a health risk." The burden is placed on the underground injection operator to demonstrate that his operation will not result in endangerment. Applicants for permits for new injection will be expected to bear a heavier burden or proof than the operation of an existing well.

The legislative history of the Act suggests that any underground source with a level of total dissolved solids of 10,000 mg/l or less should be protected, and the regulations so define "underground drinking water sources." However, it is felt to be a misallocation of resources to protect aquifers as drinking water supplies which, in fact, will not be used as such. Thus, the regulations contain a procedure whereby a state may designate one or more aquifers or portions of them with a TDS level below 10,000 mg/l but which are not to be protected because:

1. They are more valuable as oil producers;

2. They are severely contaminated; or

3. They are located in such a way that use as drinking water is impractical.

A state may also designate areas where no aquifers exist where the protective requirements will not be applicable.

Specific requirements or alternatives are set forth for surface casing, tubing and packers, annular injection, monitoring wells, and other factors. These are not detailed here because the regulations are still in proposed form and subject to revision before final promulgation.

It should be noted by the geothermal community that EPA solicits comments on all aspects of the proposed regulations and particularly welcomes useful suggestions on specified areas. In the latter category are multiple use wells such as those used for water flood and subsidence control which may not readily fit into the current categorization scheme. EPA is seeking comment on the extent and nature of these wells and on the necessity of developing different minimum requirements from those contained in the proposed regulations. All comments received on or before November 15, 1976, will be considered.

Fourteen states -- none of which are among the 15 surveyed in this report -- presently ban waste disposal wells and there is nothing in the regulations to require these states to permit the practice. Nor do the regulations force states which have more stringent regulations to reduce their requirements; they, in fact, encourage greater stringency if it is necessary to protect water supplies.

## SOLID WASTE DISPOSAL

The term "solid waste disposal" in today's parlance frequently means disposal on land whether the waste deposited there is solid, liquid, or semi-liquid. When the quantities of liquid or semi-liquid wastes generated by industry are small enough, they may be drummed for land disposal. This method is especially popular for industrial wastes when their character would preclude water disposal without expensive treatment. The drilling muds used in geothermal production are a good example of wastes other than solids which require land disposal but are usually too large to permit drumming.

NOTE: After this report was completed, the Congress passed a new Solid Waste Disposal Act which is currently awaiting the President's signature. If it becomes law, it will authorize the Environmental Protection Agency to regulate the treatment, storage, transportation, and disposal of hazardous wastes which have adverse effects on health and the environment.

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At present, the federal government has no regulatory authority over the disposal of wastes on private or state-owned land, although there are numerous bills pending in Congress to amend the Solid Waste Disposal Act or Resource Recovery Act of 1970 which would confer some authority on EPA. Thus, regulation of land disposal of waste is left to state and local jurisdiction. All states have some authority which can be applied in this field ranging from recently-adopted comprehensive solid waste codes to the mere exercise of old nuisance laws. The specific land disposal requirements of the "geothermal" states are discussed in Section V.

A potential facet of land disposal regulation which may be the most troublesome or expensive for geothermal development is the effect of so-called hazardous waste disposal regulations on the disposition of waste drilling muds. As of 1974, at least 25 states had enacted legislation or published regulations for the purpose of controlling the land disposal of hazardous wastes to some degree. Although many of these are impractical blanket prohibitions, it can be anticipated that a different approach is not far in the future in those states where it has not already been adopted -- i.e., waste management according to the nature of wastes.

The current trend in disposal methods for hazardous wastes is toward secured landfill. Secured landfills are usually differentiated from the sanitary landfills in common use in that they incorporate leachate monitoring and treatment, adequate diversion and control of surface water, and impervious containment of wastes.

California and other states have already incorporated this advanced type of landfill in their regulations. Such facilities are designated as Class I Disposal Sites which are defined as "those at which complete protection is provided for all time for the quality of ground and surface waters from all wastes deposited therein and against hazard to public health and wildlife resources." The criteria which must be met to qualify a site as Class I are, as might be expected, quite stringent. They are set forth in Section 2510 of Title 23 of the California Administrative Code. This section defines both rotary drilling muds containing toxic materials and brines from geothermal plants as Group 1 wastes for which deposit in a Class I disposal site is required.

While there are several categories of waste characteristics which may result in their designation as hazardous and in turn invoke a requirement for secured landfill, the only one which appears to be relevant to the nature of some drilling fluids is toxic chemical. No information has been developed by this study to suggest that any of these fluids have required special disposal technology because of their flammability, radioactivity, or explosive or biological properties.

The term "toxic chemical" is used generally to describe all of the manifestations of toxicity ranging from minor irritation to death and carcinogenic, mutagenic, and teratogenic effects. It is sometimes applied to substances at low concentration levels in order to build a margin of safety into their disposal because there is very little epidemiological knowledge or data on their behavior under all environmental conditions.

The chemistry of the various individual components of drilling muds has traditionally been "clouded in secrecy," to use the term of the most definitive reference on the subject [6], and the user frequently did not know what he was purchasing -- or discarding. This situation has apparently not changed appreciably since little information was made available to this study from mud manufacturers contacted. However, authorities in the State of California, for one, are chemically testing spent muds to determine their properties and deciding, on a case-by-case basis, what type of disposal is required. This is in conformance with the above definition of drilling muds containing toxic materials as Group 1 wastes.

In one instance, for example, a geothermal operator in the vicinity of The Geysers was required to build a virtually impermeable pit to receive drilling fluid in which the only potentially hazardous constituent is lignosulfonates. This material in the form most commonly used in drilling muds for geothermal use is a chromium salt which results from the chemical attachment of the chromium ion on the lignin molecule. (The lignin derives from the wastes of sulfite pulp mills.) Various metals could be used, it is understood, but chrome is the key one because of its ability to withstand the temperatures involved in geothermal wells.

Some of the chromium salts are considered by toxicological experts to be at least moderately toxic [7] which could account for this particular regulatory requirement for special handling in disposal. The presence of other heavy metals, caustic compounds, and other types of materials classified as toxic -- including hydrogen sulfide absorbed during drilling in high sulfide areas -- are likely to trigger similar state or local action under the provisions of waste management statutes and regulations. However, if California practice is an indicator, special treatment will not be required for waste muds shown by chemical analysis to be free of toxic problems.

When a hazardous constituent is distributed throughout a waste and cannot be segregated for disposal, as is the case in drilling muds, the entire waste containing it is considered hazardous and the costs for secured landfill can run up to several times the cost of ordinary landfilling in some instances. In the case of geothermal operations in remote areas, this increase could potentially be magnified by the necessity to construct their own secured landfill, as occured in the above example, or by the costs of hauling wastes to the nearest available facility which has also been required. These costs, and the disposal problem itself, can, of course, be reduced by recirculation and reuse of drilling muds to the greatest feasible extent.

This discussion is applicable to federal lands as well as to state and private lands because of a relevant provision in Geothermal Resources Operational (GRO) Order No. 4, which is discussed in Section IV. It states:

"Toxic drilling muds shall be disposed of in a manner approved by the Supervisor and in conformance with applicable federal, state, and regional standards." No definition of "toxic" is provided.

The Order also requires approved disposal for the containers in which chemical drilling mud additives are received. These, too, would qualify as hazardous wastes according to most definitions because of the chemical residue remaining in the can.

GRO Order No. 4 further requires that drill cuttings, sand, precipitates, and other solids be disposed of as directed by the Supervisor, either on-site or in approved off-site locations. EPA has issued guidelines for the land disposal of solid wastes other than hazardous wastes (Part 241, Title 40 CFR) which appear to apply. The guidelines specify that where non-federally generated solid waste is disposed of on federal land, the disposal sites must be in compliance with the guidelines. It is assumed that although leased for private pursuits, the acreage involved is federal land. In addition, the BLM/USGS regulations for geothermal leasing limits the amount of land surface a lessee may utilize for geothermal production and use to the minimum needed for such purposes. Thus, a waste disposal site might of necessity occupy other federal land, if permitted.

The guidelines are intended to provide for environmentally acceptable land disposal site operations. They do not establish new standards but set forth the requirements and recommended procedures to ensure that the design, construction, and operation of existing and future land disposal sites meet the health and environmental standards for the area in which they are located. The requirements are minimum levels of performance, and the recommended procedures suggest preferred methods by which the objectives of the requirements can be met.

The recommended procedures of the guidelines are based on sanitary landfilling. If other techniques are employed, the operator of a disposal facility would be obliged to demonstrate in advance through engineering calculations and other data that the techniques would meet the requirements.

The guidelines for design, construction, and operation for the most part probably represent what today would be considered normal disposal practice for innocuous waste materials by many large industrial operators. However, they do call for leachate collection and treatment systems where necessary to protect ground and surface water, and adequate diversion and control of surface water.

## OCEAN DISPOSAL

Ocean dumping could be an attractive means of disposing of brines or other wastes generated by some contemplated future uses of geothermal resources. The geographic location of many geothermal fields near the ocean, or possibly under it, suggests that the ability to use this as an environmentally acceptable disposal method for some wastes could impact very favorably on achieving an operating permit.

Ocean "dumping," as such, will be regulated under Parts 220-229 Title 40 CFR pursuant to the Marine Protection, Research, and Sanctuaries Act of 1972 (P.L. 92-532) and the Federal Water Pollution Control Act. The former implements the U.S. commitment made by ratification of the "Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter."

In the most recent revision of the proposed ocean dumping regulations (Federal Register, June 28, 1976), all mention of ocean outfalls is eliminated, and the regulations now apply only to dumping accomplished by vessel transport, a practice not envisioned for the geothermal industry for the foreseeable future.

However, it is noted in the Federal Register discussion that separate regulations covering ocean outfalls are in preparation. If these become available before Phase II of this study is complete, their potential effect on coastal geothermal operations will be evaluated in the Phase II report.

## CONTROL OF NOISE

The Noise Control Act of 1972 (86 Stat. 1234) vested the primary control of noise with state and local governments, but retained federal regulatory authority over the production of four categories of low noise level products. These are: construction equipment, transportation equipment, any motor or engine (including any equipment of which an engine or motor is an integral part), and electrical or electronic equipment.

With the exception of aircraft, state and local jurisdictions may adopt and enforce time-of-sale and in-use noise regulations for new products which are not yet subject to federal regulation. Once a class of new products is regulated by EPA, however, state and local noise emission regulations for the same product must be identical to the EPA requirements.

Noise standards may also be promulgated by other federal agencies in consultation with EPA. The Geological Survey has, in fact, included noise standards in GRO Order No. 4, identified and discussed in Section IV, which apply to noise levels of geothermal operations on federal leases. These limit noise levels to 65 dB(A) at a distance of 660 feet. Table III-1 shows that if The Geysers operations producing the sound levels indicated were located on a federal lease, virtually all of them would exceed the standards. The lower portion of the table provides the noise levels of more familiar activities for comparison.

Specific noise requirements of several states are presented in Section V and county standards in Section VI. Regardless of the entity promulgating standards, enforcement is exceedingly difficult because of the lack of trained personnel to interpret subjective-type standards, in some cases, and the lack of equipment needed to ascertain a violation.

## EROSION/SEDIMENTATION CONTROL

The Water Pollution Control Act does not specifically give EPA authority to promulgate regulations on non-point sources such as runoff from construc-

## TABLE III-1. COMPARISON OF NOISE LEVELS BETWEEN THE GEYSERS GEOTHERMAL AREA AND OTHER NOISE SOURCES[9]

| SOURCE | LEVEL | DISTANCE |
|---|---|---|
| The Geysers area | | |
| Drilling operation (air) | 126 dB(A) | 25 feet |
| Drilling operation (air) | 55 dB(A) | 1500 feet |
| Muffled testing well | 100 dB(A) | 25 feet |
| Muffled testing well | 65 dB(A) | 1500 feet |
| Steam line vent | 100 dB(A) | 50 feet |
| Steam line vent | 90 dB(A) | 250 feet |
| Comparative levels | | |
| Jet aircraft takeoff | 125 dB(A) | 200 feet |
| Threshold of pain | 120 dB(A) | |
| Unmuffled diesel truck | 100 dB(A) | 50 feet |
| Street corner in a large city | 75 dB(A) | |
| Residential area at night | 40 dB(A) | |

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dB(A) decibel value measured using the A weighting network of a standardized sound level meter.

tion. The only reference to such sources in the "Standards and Enforcement" title of the Act required the Administrator to publish guidelines related to the quantity and nature of such runoff and methods to control it. The other reference in the Act is that areawide waste treatment management plans (Section 208) must include a process to identify construction-related sources of pollution and procedures (including land use requirements) to control associated erosion.

Hawaii is the only one of the 15 states surveyed in this study which has enacted an erosion/sedimentation control statute. This type of legislation is rather recent, but there is sufficient interest both within EPA and the Soil Conservation Service to promote additional statutes in the near future.

The difficulty in this area is establishing any meaningful numerical or otherwise measurable standards which can be enforced. It is not anticipated, however, that requirements of the types adopted up to now in other jurisdictions to control erosion would have any particular inhibiting influence on geothermal development.

## CONTROL OF SUBSIDENCE

The few attempts to regulate subsidence are divided between surveillance measures and "after-the-fact" requirements. The surveillance measures include the survey, benchmark, and monitoring requirements of the federal geothermal regulations and GRO Order No. 4, a county Subsidence Detection Program in California which requires the installation of benchmarks, and a more detailed county subsidence and earth movement study, also in California. The regulatory requirements after subsidence has occurred or is about to occur are total or partial termination of operations. Wyoming has spelled out this procedure in more detail than others, and this section of its geothermal resources lease form is shown in Appendix I.

## CONTROL OF RADIATION

It is not anticipated that geothermal wastes containing radon or other naturally-occurring radioactive substances in small quantities will be subject to state radiation regulations which are designed for the control of radioactive materials under the primary jurisdiction of the federal Nuclear Regulatory Commission (NRC), successor to the Atomic Energy Commission. These materials are defined as follows:

> Byproduct material: Radioactive material yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material.
>
> Source material: Uranium, thorium, or any other material which the NRC declares to be source materials.
>
> Special nuclear materials: Plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material declared by NRC to be special nuclear material.

The definitions of byproduct material and special nuclear materials appear to exclude geothermal resources altogether and no chemical analyses of geothermal fields in this country examined during this study have identified uranium or thorium as a constituent. In addition, source material below a specified concentration is usually exempt from the scope of the regulations -- for example, the Nevada Rules and Regulations for Radiation Control exempt any solution in which the source material is by weight less than 0.05 percent of the solution. The status of state radiation regulation vis-a-vis NRC authority is a cloudy area beyond the scope of this study in any event.

EPA itself was recently precluded by the Supreme Court from promulgating effluent standards for any of these three classes of radioactive materials. The Court upheld the regulatory authority of the NRC. However, some state water quality standards for radioactive substances may apply, as discussed in Section V.

Thus, it is recommended that any person evaluating the legal requirements attendant to geothermal development in a given area check with the appropriate state agency or agencies and EPA regional offices to determine the application of existing radiation controls to his proposed activity. In order to facilitate this determination, cognizant state agencies are identified in Section V.

# SECTION IV

# ENVIRONMENTAL ASPECTS OF THE FEDERAL GEOTHERMAL LEASING AND DEVELOPMENT PROGRAM

Federal leasing and regulatory authority in geothermal exploration, development, and operation rests primarily in the Geothermal Steam Act of 1970 (84 Stat. Sections 1566-1574, 30 USC Sections 1001-1025). The Department of the Interior was given overall responsibility to allow mineral exploration and development while assuring rehabilitation of disturbed lands; protection of public health and safety; and full compliance with the spirit and objectives of the National Environmental Policy Act of 1969, other federal environmental legislation, and supporting executive orders and regulations.

Delegation of the authority conferred on the Secretary of the Interior by the Act is two-pronged. The Bureau of Land Management (BLM) is responsible for the leasing of the geothermal lands and the Geological Survey is charged with regulating operations on the leased lands. Additionally, USGS assesses the nature of the resource and classifies lands as known geothermal resource areas (KGRA's).

BLM is the primary contractor with USGS as a third party who has the conditional power to modify the lease. USGS also has the power to suspend operations and recommend termination of the lease. In other words, USGS controls the technical aspects of geothermal leasing; BLM controls the administrative aspects of the lease. The Geological Survey's implementation of the Act is spelled out in 30 CFR Parts 270 and 271; BLM's regulations are contained in 43 CFR Parts 3000 and 3200. Many provisions are identical or nearly so and are addressed only once in this discussion.

## ENVIRONMENTAL IMPACT EVALUATION

The regulations require evaluation of the environmental impact of geothermal operations on an area -- the federal lands and adjacent non-federal lands -- when a parcel of land is initially considered for leasing or "when the need arises." This function is performed by the BLM and the document produced is called an environmental assessment report (EAR). If BLM determines that development of a lease would constitute "a major federal action significantly affecting the quality of the human environment," the Bureau is required by the National Environmental Policy Act to prepare, before leases are issued, a formal environmental impact statement (EIS) subject to public review. Subsequent to issuance of a lease, the Geological Survey prepares an environmental analysis (EA) of the impact of the plan of operation itself -- i.e., a specific action. The necessity for an EIS may also be indicated at this point.

A generic environmental impact statement was prepared by the Department of the Interior in 1973 which assessed the social, economic, and environmental effects of the whole geothermal leasing program. It is hoped that because of the availability of this voluminous document (8) and the wealth of applicable information it contains, that full-blown environmental impact statements on specific land parcels will be held to a minimum, perhaps two to three percent. The EAR's and EA's might be considered "mini" EIS's and their cost in terms of manpower is considerably less than the $0.5 million estimate for a full EIS. In addition, the time required for an EIS could range up to two years based on experience gained from the preparation of such statements prepared in connection with other leasing programs.

Under 40 CFR Part 3200.0-6(b) the head of the agency charged with the administration of the surface of the land to be leased may elect to conduct the environmental impact evaluation. For example, this would apply to forest lands since the Forest Service is a surface management agency.

The kinds of information which must be developed in the various environmental impact evaluations are very similar to the data required for EIS's for other purposes. Those relating to NPDES permits are shown in Appendix F.

## ENVIRONMENTAL PROVISIONS OF LEASES

In accord with a Memorandum of Understanding among the BLM, USGS, and the Fish and Wildlife Service, an internal document, the Bureau of Land Management, in cooperation with the Geological Survey, formulates the general requirements of geothermal leases and issues special stipulations, as necessary, which often are concerned with environmental protection. The BLM is responsible for monitoring for compliance with environmental protection requirements outside the operating area and the USGS examines operations to insure compliance. This function is carried out by the USGS Supervisor whose duties are established by the regulations. He is a representative of the Secretary subject to the direction and supervisory authority of the USGS. He also issues orders to operators for remedial action.

The broad requirement for compliance with all applicable federal, state, and local environmental standards in the geothermal regulations is discussed above in Section II. However, in addition to any action required by the standards, the lessee is ordered by the BLM regulations to take the following specific actions:

1. Pesticides and herbicides. The lessee shall comply with all rules issued by the Department of the Interior and the Environmental Protection Agency pertaining to the use of poisonous substances on public lands.

2. Water pollution. The lessee shall conduct lease operations and maintenance in accordance with federal and state water quality standards and public health and safety standards, and applicable local water quality standards and public health and safety standards. Toxic materials shall not be released into any surface waters or underground waters. Reinjection of waste geothermal fluids into geothermal or other suitable aquifers is to be managed in accord with the lessee's plan of operation.

3. Air pollution. The lessee shall control emissions from operations in accordance with federal and state air quality standards and applicable local air quality standards.

4. Erosion control. The lessee shall minimize disturbance to vegetation, drainage channels, and stream banks. The lessee shall employ such soil and resource conservation and protective measures on the leased lands as the Supervisor deems necessary.

5. Noise control. The lessee shall control noise emissions from operations in accordance with federal and state noise emission standards and applicable local noise emission standards.

6. Sanitation and waste disposal. The lessee shall remove or dispose of all waste material generated in connection with the exploration, development, production, and transportation operations in a manner set forth in the approved plan of operation.

7. Land subsidence, seismic activity. The lessee shall take precautions necessary to minimize land subsidence or seismic activity which could result from production of geothermal resources and the disposal of waste fluid where such activity could damage or curtail the use of the geothermal resources or other resources, or other uses of the land and take such measures as stipulated to: (1) monitor operations for land subsidence and for seismic activity; and (2) maintain and, when requested, make available to the lessor, records of all monitoring activities.

8. Aesthetics. The lessee shall take aesthetics into account in the planning, design, and construction of facilities on the leased premises.

9. Fish and Wildlife. The lessee shall employ such measures as are deemed necessary to protect fish and wildlife and their habitat.

10. Antiquities and historical sites. The lessee shall conduct activities on discovered, known or suspected archaeological, paleontological, or historical sites in accordance with lease terms or specific instructions.

11. Restoration. The lessee shall provide for the restoration of all disturbed lands in an approved manner.

The USGS regulations do not reference local environmental control requirements as the BLM document does. Because of this distinction, a lessee may be confronted with a situation in which the stipulations to his lease reference and incorporate applicable local standards which are preempted by omission in the USGS operating regulations. In addition, although the Supervisor is authorized to issue more stringent standards than the existing ones, it is not inconceivable that the lease may contain more restrictive stipulations than the Supervisor's order. GRO Orders, defined and described below, offer a vehicle for minimizing potential problems generated by the minor differences between the BLM leases and USGS operating requirements. In addition USGS has the authority to insert site-specific special post-lease conditions into the lease.

The plan of operation, which must be approved by both USGS and BLM, requires, among other things, a detailed presentation of the layout of operations and narrative descriptions of proposed measures to be taken to implement the above list of environmental actions. In addition, the position of mud tanks, reserve pits, cooling towers, pipe racks, etc., are prescribed. These separately relate to water and air pollution control and noise abatement. Monitoring is required for one year prior to production to develop baseline data on existing air and water quality, noise, seismic and land subsidence activities, and ecological systems of the leased land (30 CFR, Section 270.34 (k)).

A sample BLM geothermal resources lease is shown in Appendix F. It will be seen that the lease does not specifically incorporate the compliance language of the regulations, although Section 14 could hardly be more specific in requiring protection of the environment in that all mitigating actions required by BLM shall be taken to prevent all of the types of environmental degradation enumerated above. The stringency of this section of the lease is subject only to the discretion of BLM in stipulating the required mitigating actions. The BLM notice of intent to conduct geothermal exploration operations (shown in Appendix G) does not contain, in Condition 1, the compliance language of the regulations.

Both the BLM and USGS regulations require lessees to submit annual reports on measures taken to comply with environmental requirements. USGS is closely supervising The Geysers and Imperial Valley operations, but this type of scrutiny may not be maintainable as geothermal leases increase both in acreage and numbers of lessees involved.

Lessees are also required to report within 24 hours occurrences of significant environmental damage or noncompliance with standards. The definition of "significant" is unclear, but failure to report could result in suspension or termination of the lease. On the other hand, the Supervisor is authorized, whether the report is made or not, to shut down any operations he determines are causing or can cause pollution, a feature of concern to geothermal operators. Except in extreme cases, the limitations are interpreted to give the operator a chance to remedy the problems.

BLM, much more than USGS, is highly concerned with the protection of historic or scientific values. The lease requires notification of all historic or prehistoric ruins, fossils, or artifacts discovered and specifies that they shall be left intact. Prior to commencing operations, the lessee must furnish a certified statement that archaeological values do not exist or that they may exist where land is to be disturbed. In the latter case, he must engage a qualified archaeologist to survey and salvage such values before operations may begin. Failure to comply may constitute a violation of the Antiquities Act (16 USC 431-433).

The degree of this interest is best illustrated by a recent occurrence which a BLM spokesman states is not apocryphal. The return of rocks removed from a lease site for testing was required because they formed part of the surroundings of a no longer active house of pleasure, patronized in earlier days by cowboys, which is now subject to potential entry on the list of national historic sites.

GEOTHERMAL RESOURCES OPERATIONS ORDERS

Geothermal resources operations orders are formal orders issued by USGS to supplement the general regulations found in 30 CFR 270 by detailing the procedures operations must follow in a given area or region. The purpose of this arrangement is to allow consideration of more area-specific operating and environmental conditions.

The USGS has issued seven GRO's. They are:

- GRO Order No. 1 - Exploratory Operations
- GRO Order No. 2 - Drilling, Completion, and Spacing of Geothermal Wells
- GRO Order No. 3 - Plugging and Abandonment of Wells
- GRO Order No. 4 - General Environmental Protection Requirements
- GRO Order No. 5 - Reports and Forms
- GRO Order No. 6 - Pipelines and Surface Production Facilities
- GRO Order No. 7 - Production and Royalty Measurement, Equipment and Testing Procedures

While appropriate environmental protection and reclamation measures are generally required by the GRO's, it is, as indicated above, GRO Order No. 4, promulgated on August 15, 1975, which mandates environmental protection for all stages of exploration and development in federal geothermal resources lands located in the USGS central and western regions.

Generally speaking, regardless of its stated purpose, some of the provisions of GRO Order No. 4 which are incorporated by reference into BLM leases are weaker and more ambiguous than the language of the regulations or the lease. Its overall effect will probably be determined largely by the seriousness with which lessees accept the order and how strenuously the Supervisor enforces it.

Relevant federal and state environmental standards are usually made applicable along with existing technology, but local and/or regional standards apply only in certain instances. Exceptions to compliance with any of the standards can be granted by the Supervisor on a case-by-case basis. Conversely, he may establish more stringent standards by field-order, usually in the form of special stipulations.

The lessee's overall general responsibility to protect the environment is to:

1. Provide maximum protection to the environment during exploration and development operations;

2. Rehabilitate impacted areas;

3. Protect by all necessary means the public health and safety;

4. Conduct operations in compliance with all applicable federal laws and executive orders.

Monitoring of "readily identifiable localized environmental impacts" caused by the activities specifically under the lessee's control shall be conducted by the lessee. Frequency of such monitoring activity will be decided by the Supervisor who will consider each site's conditions in establishing the monitoring rates. As described above, a year of baseline data on air, water quality, noise, seismic and land subsidence activities, and ecological systems must be generated before production goes on stream.

The following impacts and accompanying requirements are set out in the Order as being "protectable:"

° Aesthetics. Visual impact, where feasible, shall be minimized by careful site selection. The facilities should be constructed so as to blend with their natural surroundings.

° Land Use and Reclamation. Essentially, USGS requires that geothermal operations disturb land, water, and vegetation as little as possible. Operations and reclamation procedures are subject to approval by the Supervisor and the surface management agency involved (BLM, Forest Service). Since multiple use of the leased land is allowed, geothermal operations are not to interfere unreasonably with other authorized uses. Entry to fragile areas must be controlled by limited access routes or by use of special vehicles.

° Public Access. Such access is to be unrestrained except when circumstances mandate controlled access to:

  ° protect public health and safety;

  ° prevent undue interference with operations or security;

  ° protect the public, wildlife, and livestock from hazardous geothermal activity.

° Recreation. Areas designed for recreation near geothermal areas are to be "adequately protected" from degradation. Development sites are to be located 61 m (188 ft.) from established recreation sites and accompanying access routes. The Supervisor, however, may allow the lessee to relocate the recreation site if the surface management agency agrees to the change.

° Slope Stability and Erosion Control. Mitigating measures for soil and natural resource protection are required to prevent sedimentation from occurring in waterways.

° Biota. Mitigation measures required to protect endangered or threatened flora and fauna may exceed those required by the lease. Under the Endangered Species Act, reclamation and restocking of destroyed flora and fauna by the lessee is required if the area will not naturally recover.

° Cultural Resources Protection. The lessee may not disturb "any known cemetery or burial ground of any group or culture." Preservation of historic sites shall be in accordance with Executive Order 11593 ("Protection and Enhancement of the Cultural Environment") and conducted with the lessee's "due diligence." Caution must be exercised by BLM/USGS and the applicant so as to protect historically-important areas. Even if historic properties are not listed in the Historic Register, local public interest might necessitate mitigating measures by a lessee in order to offset adverse public opinion.

° Subsidence and Seismicity. Land subsidence shall be prevented by surveys and by adequate record-keeping of operations. If the Supervisor finds that subsidence is potentially significant or that it has occurred, then he may reduce or terminate operations or require seismograph monitoring equipment. Surveys shall be conducted in accordance with county/state requirements, and bench marks shall be established before "prolonged" production begins.

° Pollution and Waste Disposal. All federal and state standards with respect to air, land, water, and noise pollution must be complied with by the lessee. Additionally, erosion control and any waste disposal shall be conducted in compliance with such laws. This section is divided into various categories, with emphasis placed on control of water pollution. Requirements set out for various forms of pollution are:

- ° Natural water shall not be contaminated by the lessee. The rest of the environment shall be only minimally affected.
- ° If disposal of harmful liquids (including toxic and heated substances) cannot meet the standards, the liquids are to be injected back into a geothermal well or any other formation approved by the Supervisor.
- ° The Supervisor's approval is necessary for disposal of solid wastes at approved sites.
- ° Federal, state, or regional air pollution standards are the criteria for air emissions and the lessee must obtain any necessary permits for air emissions from the appropriate air pollution control agency. This permit plus required reports must be submitted to the Supervisor.
- ° No water pollution is permitted to occur by reason of pits and sumps. The lessee has to reasonably restore the aesthetic and natural resource values of the area when the use of pits and sumps ceases.

° The lessee is required to train operating personnel in pollution prevention methods.

° In addition to the above requirements, noise levels may not exceed 65 dB(A) unless all residents located within .8 km (0.5 mi) of the operation agree to an increased level or an emergency arises. The ambient noise level used for ranking the permissibility of additional noise is "the minimum sound level at the relevant place and time in the absence of the source noise and shall include consideration for the type of land use, and the season, atmospheric conditions, and the time of day." Noise parameters can be established by the Supervisor, after assessment, in accordance with federal or state criteria with adjustments for specific site conditions.

Noise levels are to be measured at .8 km (0.5 mi) from the source or at the lease boundary line, whichever is greater. Noise meters shall be those that meet U.S. Standard Specifications. Measurements shall be made at least three meters (9.84 ft) from a structure and one meter (3.28 ft) above ground level. Site variables, such as weather conditions, are to be taken into consideration. Monitoring frequency shall be determined by the Supervisor.

# SECTION V

# STATE STATUTES/REGULATIONS APPLICABLE TO GEOTHERMAL DEVELOPMENT

This section consists almost entirely of summaries of state legislation and regulations which may bear upon geothermal development. These documents include those which relate directly to geothermal development and others which represent the state's overall efforts to control air and water pollution and noise emissions, to regulate the disposal of solid wastes, and to require assessment of the environmental impact of activities within the state.

There are perhaps several alternative formats which could be used for presenting the summaries. It was decided, however, that the ability to compare the approach of the states in a given area of control is enhanced by grouping the summaries for all states according to subject matter -- i.e., air pollution, water quality, etc. -- rather than placing the summaries of all of a state's documents under one state listing.

It will be noted that while some of the provisions of the geothermal regulations are reasonably specific in terms of drilling and abandonment practices, for example, they do not generally set "standards," as such. A study of the summaries of air and water pollution control regulations also discloses that very few of the potential pollution parameters of geothermal wastes are covered by existing numerical standards in these documents.

The latter point is illustrated, for example, by the fact that the predominance of states have promulgated emission standards for only the six air contaminants for which EPA has set ambient air quality standards: sulfur dioxide, particulates, hydrocarbons (excluding methane), carbon monoxide, photochemical oxidants, and nitrogen oxides. None of the gases in this list are found in the various published lists of gases typically associated with geothermal resources, although there are literature references to the presence of sulfur dioxide, both in this country and New Zealand [9, 10]. It is also understood that through reaction which occurs in the power plant operations, small amounts of $SO_2$ are generated from hydrogen sulfide at The Geysers. Even if both of these occurrences were found to be universally true, $SO_2$ emissions are not likely to reach the concentration levels which would justify the importance in geothermal development which the summaries set out below attach to this pollutant. The emphasis given to it is there only because of the emphasis in the regulations and not because of a judgment of its relative significance.

It is doubtful that the hydrocarbon standards which exclude methane, and those for carbon monoxide and oxides of nitrogen, will exert any effect on geothermal activities, but they are included in this report as examples of existing standards. Photochemical oxidant standards are omitted since it is not expected that geothermal production or use will emit the pollutants necessary to form this class of second generation pollutants.

The regulation summaries also raise the issue of whether some types of current standards designed for other purposes can be applied to geothermal processes. The control of particulates illustrates this potential problem. The most popular particulate emission standard in the geothermal states is a case in point. In this standard, allowable particulate emissions are calculated on the basis of process weight per hour. Process weight can conceivably be interpreted to mean the water or steam input into a geothermally operated electric generating plant, for example, although enforcement probably would be difficult. Some of the standards exclude liquid or gaseous fuels from the weight calculation; Wyoming has carried this one step further and expressly excludes all water and steam. This language was obviously not designed with geothermal operations in mind. Another peculiarity is Utah's exemption from pre-construction requirements of exhaust systems for controlling steam and heat which do not contain combustion products. If interpreted literally, this would mean that steam could be vented which contains no fuels but which contains pollutants.

Odor will also be a troublesome parameter for the control agency and geothermal operators alike where it is a characteristic of a given resource. Many odor regulations do not define it and only embrace some very non-specific language about its control. Others simply prohibit odor without offering alternatives -- a virtually impossible type of regulation to enforce -- and others have undertaken to be so specific that they will be equally difficult of compliance. Montana, for example, provides that any operation which discharges odorous materials -- vapors, gases, dusts, or combinations thereof -- must install odor control devices or procedures specified by the state control agency. It is further required that such odorous materials be confined at the point of origin and treated before discharge. If odorous matter escapes and creates a public nuisance, the agency may order that a building or buildings where the odors originate be tightly closed and ventilated in such a way that all air, gases, and gasborne materials leaving the building are treated by incineration or other effective means.

## GEOTHERMAL RESOURCE STATUTES/REGULATIONS

The statutes enacted or regulations promulgated for the express purpose of guiding the development of geothermal resources of 15 states are listed by title in Table V-1. These states are Alaska, Arizona, California, Colorado, Hawaii, Idaho, Louisiana, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington, and Wyoming. Their agencies which adopt and administer the regulations are identified in Table V-2.

Portions of some of the statutes and regulations which are germane to environmental control are summarized below. Other documents were omitted because either they are so general in nature they would add little to this discussion or they do not involve environmental considerations.

## TABLE V-1. STATE STATUTES AND REGULATIONS
Geothermal

| State | Statute | Regulation |
|---|---|---|
| Alaska | Title 38, Alaska Statutes, Public Lands | Chapter 84, Title 11, Alaska Administrative Code, Other Leasable Minerals |
| | | Chapter 82, Title 11, Alaska Administrative Code, Mineral Leasing Procedure |
| Arizona | Geothermal Resources Act, ARS Title 27, Chapter 4, Article 4 | Geothermal Resources Rules and Regulations |
| California | Geothermal Resources Act of 1967, Public Resources Code, Division 6, Part 2, Chapter 3, Article 5.5 | Leases and Prospecting Permits for Geothermal Resources, California Administrative Code, Title 2, Division 3, Register 70 |
| | California Laws for Conservation of Geothermal Resources | |
| Colorado | Article 10, Section 1, Chapter 100, Colorado Revised Statutes 1973, Geothermal Resources Act of 1974 | General Rules and Regulations with Respect to the Conservation of Geothermal Resources in the State of Colorado, and Rules of Practice and Procedure Pertaining Thereto |
| Hawaii | Section 182-1, Hawaii Revised Statutues, Relating to Reservation and Disposition of Government Mineral Rights | Chapter 182, Reservation and Disposition of Government Mineral Rights |

Continued

Table V-1 (Continued)

| State | Statute | Regulation |
|---|---|---|
| Idaho | Section 42-4001, Idaho Code | Rules and Regulations and Minimum Well Construction Standards for Drilling for Geothermal Resources |
| Louisiana | Geothermal and Geopressure Energy Research and Development Act, Chapter 7, Part VI, Title 30, Louisiana Revised Statutes of 1950, as amended | Order No. 29-B, Statewide Order Governing the Drilling for and Producing of Oil and Gas in Louisiana |
|  | Act 134 of the Regular Session, 1976 (Geothermal Energy Resources, to Provide for Regulation of Exploration, Drilling, Production and Subsurface Disposal; to Provide for Conservation and Environmental Protection; to Provide for Leasing Procedures and Terms, Rentals and Royalties on State-Owned Lands; to Provide for Regulatory Control by the State Mineral Board and the Department of Conservation; to Provide for Records and Funds; to Preserve Rights; and to Provide for Related Matters) |  |
| Montana | An Act to Empower the Board of Land Commissioners to Lease Geothermal Resources on State Lands, Chapter 26, R.C.M. - Lease of Geothermal Resources | Geothermal Rules and Regulations, MAC Not. No. 26-2-6 |

Continued

Table V-1 (Continued)

| State | Statute | Regulation |
|---|---|---|
| Montana (continued) | Montana Utility Siting Act of 1973, Title 70, Chapter 8, R.C.M. 1947, as amended | Geothermal Investigation Reports, MAC 36-14.11 |
| Nevada | An Act Relating to Geothermal Resources, Title 48 NRS | No regulations |
| New Mexico | Geothermal Resources Conservation Act, Chapter 272, Laws of 1975 | State of New Mexico Oil Conservation Commission Rules and Regulations Geothermal Resources |
| Oregon | 1971 Geothermal Resources Act, ORS Chapters 183 and 522 | Geothermal Regulations, Chapter 632, Division 2, Oregon Administrative Rules Compilation |
| Texas | Geothermal Resources Act of 1975, Tex. Rev. Civ. Stat. Ann. Act 5421S | Railroad Commission Rules and Regulations Pertaining to Geological and Geophysical Exploration and Surveys |
| Utah |  | Rules and Regulations Governing the Issuance of Mineral Leases |
| Washington | Geothermal Resources Act, Title 79, RCW | No regulations |
| Wyoming | No statute | Rules and Regulations Governing the Issuance of Geothermal Resource Permits and Leases |

TABLE V-2. STATE AGENCIES WHICH PROMULGATE AND ADMINISTER REGULATIONS AFFECTING GEOTHERMAL PRODUCTION AND USE

| State | Promulgating Agency | Administering Agency |
|---|---|---|
| ALASKA | | |
| Geothermal | Department of Natural Resources | Land Division, DNR |
| Water | Department of Environmental Conservation | Department of Environmental Conservation |
| Air | Department of Environmental Conservation | Department of Environmental Conservation |
| Noise | No regulations | No regulations |
| Solid Waste | Department of Environmental Conservation | Department of Environmental Conservation |
| Radiation | Department of Health and Social Services | Department of Health and Social Services |
| ARIZONA | | |
| Geothermal | Oil & Gas Conservation Commission(drilling)<br>Secretary of State (leasing) | Oil & Gas Conservation Commission(drilling) |
| Water | Department of Health Services | Department of Health Services |
| Air | Department of Health Services | Department of Health Services |
| Noise | No regulations | No regulations |
| Solid Waste | Department of Health Services | Department of Health Services |
| | Atomic Energy Commission | Atomic Energy Commission |
| CALIFORNIA | | |
| Geothermal | Department of Conservation*. Division of Oil and Gas<br>Lands Commission*(leasing) | Department of Conservation*, Division of Oil and Gas<br>Lands Commission*(leasing) |
| Water | State Water Resources Control Board* and Regional Water Quality Control Boards | State Water Resources Control Board* and Regional Water Quality Control Boards |
| Air | State Air Resources Board* and Air Pollution Control Districts | State Air Resources Board* and Air Pollution Control Districts |
| Noise | Department of Health, Office of Noise Control | Department of Health, Office of Noise Control |
| Solid Waste | Solid Waste Management Board* | Solid Waste Management Board* and Department of Health |
| Radiation | Resources Agency | Resources Agency |

*All of these agencies are within the Resources Agency of California.

Continued

TABLE V-2 (Continued)

| State | Promulgating Agency | Administering Agency |
|---|---|---|
| COLORADO | | |
| Geothermal | Department of Natural Resources(leasing)<br>Oil and Gas Conservation Commission (conservation) | Department of Natural Resources(leasing)<br>Oil and Gas Conservation Commission (conservation) |
| Water | Water Quality Control Commission, Department of Health | Water Quality Control Commission, Department of Health |
| Air | Air Pollution Control Commission | Division of Air Pollution Control, Department of Health |
| Noise | No regulations | No regulations |
| Solid Waste | Department of Health | Department of Health |
| Radiation | Department of Health | Department of Health |
| HAWAII | | |
| Geothermal | Department of Land and Natural Resources | Department of Land and Natural Resources |
| Water | Department of Health | Department of Health |
| Air | Department of Health | Department of Health |
| Noise | Department of Health | Department of Health |
| Solid Waste | Department of Health | Department of Health |
| Radiation | Department of Health | Department of Health |
| IDAHO | | |
| Geothermal | Department of Water Resources<br>Board of Land Commissioners (leasing) | Department of Water Resources |
| Water | Board of Environmental and Community Services | Department of Environmental and Community Services |
| Air | Board of Health and Welfare | Department of Health and Welfare |
| Noise | No regulations | No regulations |
| Solid Waste | Board of Health and Welfare | Department of Health and Welfare |
| Radiation | Board of Health and Welfare | Department of Health and Welfare |
| LOUISIANA | | |
| Geothermal | Mineral Board (leasing)<br>Department of Conservation (R&D) | Mineral Board (leasing)<br>Department of Conservation (R&D) |

Continued

TABLE V-2 (Continued)

| State | Promulgating Agency | Administering Agency |
|---|---|---|
| Louisiana Cont'd. | | |
| Water | Stream Control Commission | Division of Water Pollution Control, Wildlife and Fisheries Commission |
| Air | Air Control Commission | Health and Human Resources Administration |
| Noise | No regulations | No regulations |
| Solid Waste | Health and Human Resources Administration | Health and Human Resources Administration |
| Radiation | Division of Radiation Control (regulations approved by Board of Nuclear Energy) | Division of Radiation Control |
| MONTANA | | |
| Geothermal | Board of Natural Resources and Conservation | Board of Natural Resources and Conservation |
| Water | Board of Health and Environmental Sciences | Department of Health and Environmental Sciences |
| Air | Board of Health and Environmental Sciences | Department of Health and Environmental Sciences |
| Noise | Board of Health and Environmental Sciences | Department of Health and Environmental Sciences |
| Solid Waste | Division of Environmental Sanitation, Department of Health | Division of Environmental Sanitation, Department of Health |
| Radiation | Board of Health and Environmental Sciences | Department of Health and Environmental Sciences |
| NEVADA | | |
| Geothermal | State Engineer | Department of Conservation and Natural Resources |
| Water | Environmental Commission | Department of Human Resources |
| Air | Environmental Commission | Department of Human Resources |
| Noise | Environmental Commission | Department of Human Resources |
| Solid Waste | Board of Health | Solid Waste Office, Bureau of Environmental Health |
| Radiation | Board of Health | Consumer Health Protection Service |

Continued

TABLE V-2 (Continued)

| State | Promulgating Agency | Administering Agency |
|---|---|---|
| NEW MEXICO | | |
| Geothermal | Oil Conservation Commission | Oil Conservation Commission |
| Water | Environmental Improvement Board | Environmental Improvement Agency |
| Air | Environmental Improvement Board | Environmental Improvement Board |
| Noise | Environmental Improvement Board | Environmental Improvement Board |
| Solid Waste | Environmental Improvement Board | Environmental Improvement Board |
| Radiation | Environmental Improvement Board | Environmental Improvement Board |
| OREGON | | |
| Geothermal | Department of Geology and Mineral Industries | State Geologist |
| Water | Environmental Quality Commission | Department of Environmental Quality |
| Air | Environmental Quality Commission | Department of Environmental Quality |
| Noise | Environmental Quality Commission | Department of Environmental Quality |
| Solid Waste | Environmental Quality Commission | Department of Environmental Quality |
| Radiation | Environmental Quality Commission | Department of Environmental Quality |
| TEXAS | | |
| Geothermal | Railroad Commission (regulatory)<br>General Land Office (leasing) | Railroad Commission (regulatory)<br>General Land Office (leasing) |
| Water | Water Quality Board | Water Quality Board |
| Air | Air Control Board | Air Control Board |
| Noise | No regulations | No regulations |
| Solid Waste | Department of Health Resources | Department of Health Resources |
| Radiation | Department of Health Resources | Department of Health Resources |
| UTAH | | |
| Geothermal | State Land Board | Department of Natural Resources, Division of State Lands<br>Office of State Engineer, Division of Water Rights<br>Department of Social Services |
| Water | Board of Health and Water Pollution Control Committee | |
| Air | Board of Health and Air Conservation Committee | Department of Social Services |

Continued

TABLE V-2 (Continued)

| State | Promulgating Agency | Administering Agency |
|---|---|---|
| Utah Cont'd. | | |
| Noise | No statute | No regulations |
| Solid Waste | Board of Health and Water Pollution Committee | Department of Social Services |
| Radiation | Department of Social Services | No regulations |
| WASHINGTON | | |
| Geothermal | Department of Natural Resources (in some cases with concurrence of the Department of Ecology) | Department of Natural Resources |
| Water | Department of Ecology | Department of Ecology |
| Air | Department of Ecology (and nine local air pollution control agencies) | Department of Ecology |
| Noise | Department of Ecology | Department of Ecology |
| Solid Waste | Department of Ecology (along with local health departments) | Department of Ecology |
| Radiation | Department of Ecology | Department of Ecology |
| WYOMING | | |
| Geothermal | State Board of Land Commissioners | State Board of Land Commissioners |
| Water | Environmental Quality Council | Department of Environmental Quality |
| Air | Environmental Quality Council | Department of Environmental Quality |
| Noise | No regulations | No regulations |
| Solid Waste | Environmental Quality Council | Department of Environmental Quality |
| Radiation | No regulations | No regulations |

In addition, repetition of very general provisions common to the documents summarized has been omitted for the sake of brevity. Mandatory compliance by an operator with all applicable federal, state, and county laws and right-of-entry authority for the environmental regulatory agency typify this type of provision.

In general, the requirements for restoration of a completed or abandoned well site have also been omitted. These most frequently require that the area be returned to its original condition to the extent practicable. While this may involve effort and expenditures which an operator would not undertake if left to his own devices, it is sufficiently common to applicable regulations that this practice is or probably will soon become a universally required procedure. Past experience with strip mining has apparently led legislators and regulatory agencies to attempt to avoid this type of environmental damage at the outset.

Similarly, requirements for structures and landscaping harmonious with the area are not repeated throughout the summaries. This, too, is generally applied.

It is emphasized that the summaries do not represent the content of the whole document and that provisions which duplicate the requirements of others are not always repeated.

## Alaska

Title 38 of the Alaska Statutes - Public Lands --
Rights to develop and utilize geothermal resources underlying lands owned by the State of Alaska may be acquired solely under the provisions of Sec. 38.05.181 of the Alaska Statutes. The right to prospect for geothermal resources is acquired under a permit, and a lease entitles the lessee to produce and utilize geothermal resources.

The more general provisions of Title 38 place the control and supervision of state lands, including leasing for mineral development, in the Division of Lands in the Department of Natural Resources. The Commissioner of the Department is directed to supervise the administration of the Land Division and to establish procedures and adopt rules and regulations necessary to carry out the applicable statutory requirements of Title 38. The Director of the Division is directed to implement the rules and regulations, to prescribe leasing procedures and practices, and to lease lands under statutory conditions and limitations.

In addition, the Director may, with the consent of the Commissioner, impose additional conditions or limitations as he determines will best serve the interest of the state. This is a very broad regulatory authority in terms of the environmental requirements which could conceivably be applied. More specifically, Sec. 38.105.181, which relates only to geothermal resources, grants the Commissioner and the Director all the powers necessary to carry out the purposes of the section, and a liberal construction of the section to meet its objectives is mandated. The purposes of the section include the authority to enforce conservation practices and pollution control measures.

Sec. 38.05.181 (p)(3) requires that geothermal wells be constructed in accordance with methods approved by the Commissioner. The owner or operator is to make every reasonable effort to:

1. Prevent damage to life, health, property, and natural resources.

2. Protect the geothermal deposits from damage or waste.

3. Shut out detrimental substances from underground and surface water suitable for irrigation or domestic purposes.

4. Prevent the infiltration of detrimental substances into underground and surface waters.

The Commissioner is authorized to require any monitoring or remedial work necessary to ensure that these conditions are met. He may require the assistance of the Department of Environmental Conservation in this effort.

There is still another condition of a geothermal lease with a potential for indirect environmental ramifications. This is the requirement that if the production or utilization of geothermal steam is susceptible of producing a valuable byproduct, including demineralized water, the lessee must undertake substantial production or use of the byproduct unless this requirement is modified or waived by the Commissioner. The Commissioner may base such an action on conservation of natural resources or "other reasons satisfactory to him." Environmental protection is obviously inherent in this broad stipulation if the production of a byproduct results in pollution beyond that generated by the production or use of the geothermal resource alone or changes the character of wastes which would be expected without the byproduct production. The Director may waive or amend operating requirements of leases or regulations affecting leases in the interest of conservation or to facilitate the greatest ultimate recovery of geothermal resources.

Chapter 84, Alaska Administrative Code-Coal and Other Leasable Minerals--

The primary purpose of Article 7, Geothermal Resources, of Chapter 84 is to establish the mechanism by which competitive geothermal leases and noncompetitive geothermal prospecting permits are issued. From an environmental control standpoint, the focus of this article is the requirement imposed upon geothermal permittees and lessees to submit a plan of operation which must be approved by the Director before any operations on a permit or lease may begin. Operations under the plan are subject to any conditions the Director may determine are necessary to prevent waste and to protect or minimize damage to the land and its resources. This provision invokes the broad statutory authority given to the Director.

Chapter 82, Alaska Administrative Code-Mineral Leasing Procedure--

There are no provisions in Chapter 82 which relate directly to environmental control. However, the production of data requirement in 11 AAC 82.805 could provide an indirect regulatory tool. This section requires that, "for purposes of determining compliance with the terms and conditions of a mineral lease or compliance with the Alaska Statutes and the regulations adopted under them, the lessee of a state-issued mineral lease shall furnish, upon request of the Director, a copy of all factual data, which will include all pertinent tests, records, data surveys and analyses conducted on or pertaining to the leased lands or products from them . . . All information submitted in accordance with this section may be held confidential and shall only be used for the administration of the functions, responsibilities, and duties vested by law in the commissioner or director."

The use of this as an environmental regulatory mechanism would hinge on the interpretation of the terms "determining compliance" and "functions, responsibilities, and duties." If these mean that the Commissioner may use the "confidential" data to enforce lease terms or conditions of the plan of operation related to environmental protection, then the production of data could conceivably set in motion a regulatory action if it revealed environmental degradation which had not otherwise been detected or reported. Except in the extreme case of revocation of a lease, this type action would probably be initiated by the Department of Environmental Conservation.

## Arizona

Title 27, Chapter 4, Arizona Revised Statutes - Geothermal Resources --
This chapter authorizes the Oil and Gas Conservation Commission to oversee geothermal activity.

The environmental requirements include: (1) a directive to the Commission to prevent the discharge of any fluids or gases or disposition of substances harmful to the environment by reason of drilling, operation, maintenance, or abandonment of geothermal wells; (2) watertight casing for bore holes penetrating an aquifer to a geothermal resource below; (3) construction and maintenance of all geothermal water and brine disposal systems so as to avoid contamination of underground or surface waters; water quantity and quality monitoring devices; reinjection of geothermal effluent or injection of other water supplies into the producing zones at the discretion of the Commission.

(NOTE: The Arizona regulations governing leasing of lands for geothermal development were not provided to the study. This is because leasing has been suspended pending a definition of geothermal resources and their byproducts by the State Attorney General.)

Rules and Regulations Adopted by the Arizona Oil and Gas Conservation Commission Pursuant to Title 27, Chapter 4, Revised Statutes --
These regulations deal primarily with drilling of wells and operation practices which are not of direct concern to this discussion. However, the engineering and documentation requirements during drilling and testing can be summarized as follows:

An application for a drilling permit must be accompanied by a plot showing the exact acreage or legal subdivision allotted to a well. The major purpose of the plot is to permit the Commission to determine whether the well is a permitted location under the well-spacing program requested in the application. The commission is authorized to approve well-spacing programs or prescribe modifications after giving consideration to factors such as the following: (1) topographic characteristics of the area; (2) hydrologic, geologic, and reservoir characteristics of the field; (3) the number of wells that can be economically drilled to provide the necessary volume of geothermal resources for the intended use; (4) protection of correlative rights; (5) minimizing well interference; (6) unreasonable interference with multiple use of lands; and (7) protection of the environment. In order to assure a supply of drilling mud to confine oil, gas, water, or other fluid to its native stratum during the drilling of a well, operators must provide an adequate pit, either earthen or portable, for this fluid or the accumulation of drill cuttings.

Casing requirements are spelled out in great detail in Rules G-107 through G-112, both for areas where pressure and formations are unknown and where the subsurface conditions have been established. No well may be directionally deviated from its normal course without permission from the Commission and public hearing, except that wells may be intentially deviated for short distances to straighten the hole, sidetract junk, or correct other mechanical difficulties. Directional survey of wells may be required.

A well operator must minimize noise when conducting air drilling operations or when the well is allowed to produce while drilling. The noise created by the expanding gases must be abated by methods approved by the Commission.

There are two sets of environmental practices set forth under well operating practices. The first is headed "Pollution and Surface Damage" and reads as follows:

> "The owner or operator shall take all reasonable precautions to avoid polluting streams, polluting underground water, and damaging soil. If any deleterious substances cannot be treated or destroyed, or if the volume of such products is too great for disposal by the usual methods without damage, other means of disposal, after approval by the Commission, shall be used."

The second is entitled "Environmental Protection" and reads as follows:

> "In the absence of coverage by any other Section of these regulations, the Commission shall require operations under this Chapter to be conducted so as not to pollute the underground water or the land upon which the operations are being conducted, or pollute underground waters of neighboring lands. Federal and State air and water quality standards will be followed unless more stringent requirements are stipulated by the Commission. Plans for disposal of well effluents must take into account the effect on groundwaters, streams, plants, fish and wildlife and their populations, atmosphere, or any other effects which may cause or contribute to pollution, and such plans must be approved by the Commission before action is taken under them."

Brines and salt water liquids must be disposed of by evaporation in earthen pits or by underground injection as authorized by the Commission. Earthen pits must be constructed to prevent escape of brines and entry of surface water into the pit.

Injection of substances to increase recovery of geothermal resources is prohibited unless authorized by the Commission. Strict requirements on the construction of such injection wells are set forth.

California

Geothermal Resources Act of 1967 (Public Resources Code, Division 6 - Public Lands, Part 2 - Leasing of Public Lands, Chapter 3 - Oil and Gas and Mineral Leases) --

Prospecting permits and leases for the extraction and removal of geothermal resources from California state lands are issued under this Act. Proposed waste discharge reports must be filed with the Regional Water Quality Control Board and operations must comply with waste discharge requirements set by the board as provided by Chapter 4, Division 7, of the Water Code. Operations must also comply with applicable provisions of law under jurisdiction of the Department of Parks and Recreation, the Department of Fish and Game, and the Division of Forestry, together with their applicable rules and regulations. The applicable sections of the Fish and Game Code prohibit the deposit of any industrial waste, liquid or solid, in waters of the state or placement so that it might enter into waters. The drilling, operation, maintenance, and abandonment of wells must also comply with Chapter 4, Division 3, of the Public Resources Code, described below.

The Commission may require production or use of other of the geothermal resources upon determination that this is economically feasible and that a market exists for such production. Underlining is provided to show the difference between this provision and the similar Alaska requirement.

A permittee or lessee may, upon the approval of the Commission, drill special wells, convert producing wells, or reactivate and convert abandoned wells for the sole purpose of reinjecting geothermal resources or the residue thereof.

Title 2, California Administrative Code Division 3 - State Property Operations Article 4.1 - Leases and Prospecting Permits for Geothermal Resources --

This regulation is administered by the State Lands Commission. In filing applications to the Commission for a geothermal prospecting permit the quality and use of underlying groundwaters and adjacent surface waters must be described, and the proposed methods of disposing of liquid, solid, or gaseous wastes must be stated. These must protect and preserve existing land and water uses.

The engineering and documentation requirements during drilling and testing are set forth in the Section (2257) entitled "Development Program." These are shown in full here because they are typical of requirements which appear in one or another of the various geothermal regulations.

"DEVELOPMENT PROGRAM.

"(a) Operations under any lease or permit shall be carried on in a safe and workmanlike manner in accordance with generally accepted good engineering practice and due regard shall be given the protection of life and property, preservation of the environment and the conservation of natural resources.

"(b) The State Lands Division may determine the spacing of wells and the rate of development and production of such wells to prevent the waste of geothermal resources and to promote their maximum economic recovery from, and the conservation of reservoir energy in, each zone or separate underground source of geothermal resources. Such determination shall be based on recognized engineering standards and shall be consistent with prevailing economic conditions.

"(c) Geothermal resources shall not be disposed of except in accordance with sales contracts or other methods which have first been approved of in writing by the State Lands Commission.

"(d) All geothermal resources wells shall be tested when required by the State Lands Division.

"(e) No lessee or permitee shall drill a geothermal resources well on or into state lands except on prior approval of the State Lands Division and subject to the terms of the enabling statute and lease or permit.

"(f) Lessee or permittee, before commencing the work of drilling a well, shall notify the State Lands Division of its intention to drill, and such notice shall contain the location and elevation above sea level of derrick, proposed depth, bottom hole location, casing program, proposed completion program and the size and shape of drilling site, excavation and grading planned, and location of existing and proposed access roads. Where the surface of the leased or permitted lands is under the jurisdiction of a state agency other than the Commission, lessee or permittee shall provide at the same time such information listed above as is pertinent to that agency.

"(g) No well shall be perforated, redrilled, plugged back, or altered except on prior approval of the State Lands Division.

"(h) All drilling, redrilling, perforating, or work-over operations within any geothermal resources zone shall be done with an accepted circulating medium.

"(i) No generating plants, buildings, structures, production equipment, metering system, pipelines or roads for the production of geothermal resources shall be installed except on prior state approval. Any changes in said equipment or facilities shall be approved prior thereto. Maps, drawings and specifications for said installations shall be furnished upon request.

"(j) Metering equipment shall be maintained and operated in such a manner as to meet acceptable standards of accuracy. Use of such equipment shall be discontinued at any time upon determination by the State Lands Division that standards of accuracy or quality are not being maintained, with production stopped until measurement accuracy has been obtained.

"(k) Lessee or permittee shall diligently maintain all wells and continuously vent and periodically blow wells to prevent water condensation and cooling of the well bore.

"(l) Before work is commenced to abandon any well, notice shall be given to the State Lands Division, which notice shall show the condition of the well and the proposed method of abandonment. No well may be abandoned unless prior approval of the method of abandonment has been obtained from the State Lands Division."

Section 2263 prescribing measures for the protection of other resources is also presented in full because its separate provisions appear to illustrate the types of directives to which geothermal operators will be required to conform:

"PROTECTION OF OTHER RESOURCES.

"(a) The lessee or permittee shall remove the derrick and other equipment and facilities within sixty (60) days after lessee or permittee has ceased making use thereof in its operations.

"(b) All permanent operating sites where required shall be landscaped or fenced so as to screen them from public view as far as possible. Such landscaping or fencing shall be approved in advance by the state and kept in good condition.

"(c) All drilling and production operations shall be conducted in such manner as to eliminate as far as practicable dust, noise, vibration, or noxious odors. Operating sites shall be kept neat, clean, and safe. Drilling dust shall be controlled to prevent widespread deposition of dust. Detrimental material deposited on trees and vegetation shall be removed. The determination as to what is detrimental is a state responsibility.

"(d) Wastes shall be discharged in accordance with requirements and prohibitions prescribed by the Regional Water Quality Control Board. The State Lands Division and the state agency having jurisdiction over the affected lands shall also approve the place and manner of such waste disposal.

"(e) Lessee or permittee shall communicate with the Department of Fish and Game prior to any operations which may adversely affect fish and wildlife resources.

"(f) Any operations disturbing the soil surface, including road building, construction, and movement of heavy equipment in support of or relating to specific geothermal exploration or development activities shall be conducted in such manner as will not result in unreasonable damage to trees and plant cover, soil erosion, or in degradation of waters of the State, including fish and aquatic life habitat.

"(g) Pollution of the ocean and tidelands, rivers, lakes or other bodies of water, and all impairment of and interference with bathing, fishing, or navigation in the waters of the ocean, or any bay or inlet thereof, is prohibited, and no brine, minerals, or any refuse of any kind from any well or works shall be permitted to be deposited on or pass into waters of the ocean, any bay or inlet thereof, rivers, lakes or other bodies of water, without specific written state authorization.

"(h) No permanent filled lands, piers, platforms or other fixed or floating structures in, on, or over the tide and submerged lands covered by the lease or permit or otherwise available to the lessee or permittee shall be permitted to be constructed, used, maintained, or operated without obtaining any and all permits required under applicable state and federal law, rules and regulations, or complying with all valid ordinances of cities and counties applicable to lessee's or permittee's operations, or without securing the written permission of the State Lands Division specifically authorizing the activity.

"(i) Existing roads and bridges on or serving the area under lease or permit shall be maintained in a condition equal to or better than that before use. New roads and bridges shall be located, constructed, and maintained in accordance with state specifications.

"(j) Timber damaged, destroyed, or used on the area under lease or permit shall be compensated at market value to the state. Borrow pit material shall not be obtained from state lands without permission and payment of market value.

"(k) Improvements, structures, telephone lines, trails, ditches, pipelines, water developments, fences and other property of the state or other lessees or permittees, and permanent improvements and crops of surface owners, shall be protected from damage and repaired or replaced when damaged.

"(l) Access to drilling or production sites by the public shall be controlled by the lessee or permittee to prevent accidents or injury to persons or property.

"(m) Drilling mud shall be ponded in a safe manner and place, and where required by the state, posted with danger signs, and fenced to protect persons, domestic animals, and wildlife. Upon completion of drilling, the mud shall be disposed of, or after drying in place, covered with a protective layer of soil.

"(n) Areas cleared and graded for drilling and production facility sites shall be kept to a reasonable number and size, and be subject to state approval.

"(o) Lessee or permittee shall conduct its operations in a manner which will not interfere with the right of the public to fish upon and from the public lands of the state and in the waters thereof or will not preclude the right of the public to use of public lands and waters."

The suspension of drilling and production operations is required (1) in the event of disaster or of pollution caused by the operations or (2) when the State Lands Division determines that there is a substantial likelihood that continued operations would endanger public health or safety or cause serious damage to property or the natural environment.

California Laws for Conservation of Geothermal Resources (Public Resources Code, Sec. 3714 and 3741, Division 3, Chapter 4)--
When a developer files notice of intent to drill, either on state or private land, he becomes subject to this statute which places well safety and conservation of the resource under the Division of Oil and Gas in the Department of Conservation. The State Oil and Gas Supervisor is directed to permit well operators to utilize all methods and practices known to the industry which will increase the ultimate recovery of the resource suitable on a case-by-case basis. State policy is enunciated which interprets the right or power granted to operators to explore for and remove geothermal resources to allow them to do "what a prudent operator using reasonable diligence would do . . . in producing and removing resources . . ."

Approval of the notice of intent to drill by the Supervisor is required before drilling may begin. This applies to original drilling, redrilling of an abandoned well, deepening a well, plugging, or altering or removing the casing of a well.

The regulatory power of the Oil and Gas Division includes authority to require indemnity bonds; logs on well characteristics and drilling activities; approved casing strength; tests or remedial work; and approved and supervised abandonment procedures. The log records may not be used in court or other enforcement proceedings except in limited instances for review of enforcement decisions by the Supervisor or the Geothermal Resources Board. The Board consists of: The Director of Conservation, State Geologist, Oil and Gas Supervisor, Executive Officer of the State Lands Commission, Chariman of the Water Resources Control Board, Director of Water Resources, Director of the Department of Fish and Game, and President of the Public Utilities Commission.

If an operator does not perform required remedial work ordered to protect environmental or other values, state agents may enter the premises and do the work, the cost of which then constitutes a lien on the property. Wells drilled within 30.5 m (100 ft) of an outer property boundary or a public street or highway are declared nuisances. This distance is reduced to 8.0 m (25 ft) to accommodate directional drilling when insufficient surface area of a land parcel of one acre or more is available for locating a well, and to a 4.5 m (15 ft) for the drilling of low temperature wells under the direction of the Supervisor.

Colorado

Special Rules and Regulations Relating to Geothermal Resources Leases --
These regulations are administered by the State Board of Land Commissioners, Department of Natural Resources. However, the Land Board has control over the disposition of solid and liquid wastes and air emissions. To minimize damage to fresh water, consultation with the Land Board and the State Engineer's Office is required on the drilling, plugging, and completion or abandonment procedures planned for all wells before drilling is commenced.

During exploration, development, and production stages a geothermal lessee is required to conduct his operations in a manner satisfactory to federal and state water and air pollution control agencies. Methods for disposal of all solid or liquid waste must have the approval of the Land Board, and no wastes may be stored in such a manner as may pollute surface or subsurface waters.

The geothermal lease form used by Colorado does not directly address environmental obligations; the usual "compliance with law" section is the only indirect reference. General Land Board regulations relating to mineral procedures also apply to geothermal lessees.

General Rules and Regulations with Respect to the Conservation of Geothermal Resources in the State of Colorado and Rules of Practice and Procedure Pertaining Thereto --

The Oil and Gas Conservation Commission adopted the above rules in April of this year pursuant to the Colorado Geothermal Resources Act of 1974. They are understood to contain non-specific environmental control requirements and "wild" well control. However, the regulations have not yet been filed with the State Attorney General and copies are not available at this time.

### Hawaii

Chapter 182, Reservation and Disposition of Government Minerals Rights --

These regulations implement a 1974 amendment to Section 182.1 of the Hawaii Revised Statutes to include geothermal resources among the minerals for which state lands may be leased. The only environmentally-oriented references are a requirement that the resource shall be removed by means reasonable and satisfactory to the Board of Land and Natural Resources and that the lessee shall comply with all water and air pollution control laws, rules, and regulations of the state or its political subdivisions.

### Idaho

Drilling for Geothermal Resources Rules and Regulations and Minimum Construction Standards --

Sections 42-4001-4015 of the Idaho Code conferred upon the Department of Water Resources the authority to regulate the drilling, operation, maintenance, and abandonment of all geothermal wells in the state. The Department's authority also includes regulatory jurisdiction over environmental hazards pertaining to the exploration and development of geothermal resources.

The Foreword to the rules states that they apply only to wells 305 m (1,000 ft) or deeper, including those drilled for exploratory purposes as defined in Section 3.10. Wells shallower than 305 m (1,000 ft) are not covered "even though the well may be for seismic work, heat flow, or other exploration." These limitations, however, are evidently open to interpretation because a Department spokesman states: "All exploratory wells over 15.4 cm (6 in) in diameter are covered by our regulation and require a geothermal permit regardless of depth. All geothermal production or injection wells regardless of size or depth are also covered by the rules and regulations."

The rules give the Department very specific authority over drilling practices and well spacing. A permit is required to drill a well, modify an existing one, or convert a production well to an injection well.

The Water Resources Director is required to approve all well spacing programs or prescribe modifications he feels are necessary for proper development considering the same factors as those enumerated in the Arizona regulations.

The casing and blow-out prevention requirements of these rules are so specific that their total impact would be lost in summarizing them. They are thus reproduced in full in Figure V-1.

There are additional blow-out prevention requirements established both for explored and unexplored areas. A Department employee may be present during any drilling phase in the latter and may order additional casing to be run if he sees fit. A logging unit must be installed and operated continuously once the shoe has been drilled out of the conductor pipe until the well has been drilled to the total depth. Data to be recorded include:

1. Drilling mud temperatures (in and out).
2. Drilling mud pit level.
3. Drilling mud pump volume.
4. Drilling mud weight.
5. Drilling rate.
6. Hydrocarbon and hydrogen sulfide gas volume (with alarm).

An annular BOPE (blow-out prevention equipment) with a minimum working pressure of 68.04 atm (1,000 PSI) is required on the surface casing and the conductor pipe. If the exit drilling mud temperature reaches 125°C (257°F), drilling operations must cease until the Department of Water Resources has been notified.

In explored areas a gate valve with a minimum working pressure rating of 20.41 atm (300 PSI) and a BOPE as described above are required on the casing head. Mud temperature must be monitored continuously or read manually and logged for each 9 m (30 ft) of depth drilled.

Equally specific abandonment requirements are set forth which cover type and placing of cement and use of drilling fluid in the procedure.

Louisiana

Act No. 735 of 1975 Louisiana Geothermal and Geopressured Energy Research and Development Act --

This Act gave the State Department of Conservation the responsibility for the management and coordination of a geothermal and geopressure energy research and development program. Among its responsibilities were the determination of the environmental ramifications and the legal, social, and economic consequences of geothermal development, and providing a framework of policy alternatives for the commercial utilization of this resource.

# FIGURE V-1. EXCERPT FROM IDAHO RULES AND REGULATIONS
# MINIMUM WELL CONSTRUCTION STANDARDS FOR GEOTHERMAL RESOURCES

4.6 Casing

4.6.1 General. All wells shall be cased in such a manner as to protect or minimize damage to the environment, usable groundwaters, geothermal resources, life, health, and property. The permanent well head completion equipment shall be attached to the production casing or to the intermediate casing if production casing does not reach the surface. No permanent well head equipment may be attached to any conductor of surface casing alone. The specification for casing strength shall be determined by the Director on a well-to-well basis. All casing reaching the surface shall provide adequate anchorage for blow out prevention equipment, hole pressure control, and protection for natural resources. The following casing requirements are general but should be used as guidelines in submitting applications for permit to drill.

4.6.2 Conductor pipe. A minimum of 40 feet of conductor pipe shall be installed. The annular space is to be cemented solid to the surface. A 24-hour cure period for the grout must be allowed prior to drilling out the shoe unless additives sufficient, as determined by the Director, are used to obtain early strength. An annular blow out preventor shall be installed on all exploratory wells and on development wells when deemed necessary by the department.

4.6.3 Surface casing. The surface casing hole shall be logged with an induction electrical log or equivalent or gamma-neutron log before running casing. This requirement may be waived by the Director. Permission to waive this requirement must be granted by the Director in writing prior to running surface casing. This casing shall provide for control of formation fluids, protection of shallow usable groundwater, and for adequate anchorage for blow out prevention equipment. All surface casing shall be cemented solid to the surface. A 24-hour cure period shall be allowed prior to drilling out the shoe of the surface casing unless additives sufficient, as determined by the Director, are used to obtain early strength.

a) A minimum of 200 feet of surface casing shall be set in areas where pressures and formations are unknown; sufficient surface casing shall be run to reach a depth below all known or reasonably estimated groundwater levels to prevent blow outs or uncontrolled flows. In no case may surface casing be set at a depth less than 10 percent of the proposed total depth of the well.

b) In areas of known high formation pressure, surface casing shall be set at the depth determined by the Director after a study of geologic conditions in the area.

c) In areas where subsurface geological conditions are variable or unknown surface casing shall be in accordance with specifications as outlined in (a) above. The casing must be seated through a sufficient series of low permeability, competent lithologic units such as claystone, siltstone, basalt, etc., to insure a solid anchor for blow out prevention equipment and to protect usable groundwater from contamination. A second string of surface casing may be required if the first string has not been cemented through a sufficient series of such beds, or a rapidly increasing thermal gradient or formation pressures are encountered.

d) The temperature of the return drilling mud shall be monitored continuously during the drilling of the surface casing hole. Either a continuous temperature-monitoring device shall be installed and maintained in a working condition or the temperature shall be read manually. In either case, the return temperature shall be entered into the log book for each 30 feet of depth drilled.

e) Blow out prevention equipment capable of shutting in the well during any operation shall be installed on the surface casing and maintained ready for use at all times. BOPE pressure tests shall be performed by the operator for department personnel on all exploratory wells prior to drilling out the shoe of the surface casing. The decision to perform BOPE pressure tests on other types of wells shall be made on a well-to-well basis by the Director. The Director must be notified five days in advance of a scheduled pressure test. Permission to proceed with the test sooner may be given orally by the Director upon request by the operator.

4.6.4 Intermediate casing. Intermediate casing shall be required for protection against anomalous pressure zones, cave-ins, washouts, abnormal temperature zones, uncontrollable lost circulation zones or other drilling hazards. Intermediate casing strings when installed shall be cemented solid to the surface or to the top of the casing.

4.6.5 Production casing. Production casing may be set above or through the producing or injection zone and cemented either below or just above the objective zones. Sufficient cement shall be used to exclude overlying formation fluids from the geothermal zone, to segregate zones, and to prevent movement of fluids behind the casing into possible fresh groundwater zones. Production casing shall either be cemented solid to the surface or lapped into the intermediate casing if run. If the production casing is lapped into an intermediate string, the casing overlap shall be at least 50 feet, the lap shall be cemented solid, and the lap shall be pressure tested to insure its integrity.

4.7 Electric Logging. All wells except observation wells shall be logged with an induction electrical log or equivalent or gamma-neutron log from the bottom of the hole to the bottom of the conductor pipe. This requirement may be modified or waived by the Director upon written request.

Act No. 134 of 1976 Geothermal Energy Resources --

This Act vests full regulatory authority over all geothermal exploration, drilling, development, and production as well as subsurface disposal of geothermal waters and/or waste in the Department of Conservation. The provisions of the Louisiana State Conservation Act (R.S. 30:1, et seq.) are extended to all geothermal operations, and the Commissioner of Conservation is empowered to promulgate such further rules and regulations as he deems necessary.

The Stream Control Commission is given supervisory authority over discharges to surface streams, and the State Mineral Board is vested with exclusive authority to lease state lands for geothermal purposes. However, the above-described regulation of conservation applies to all geothermal operations in the state, whether on public or private land. "In all cases," the Act states, "a lessee under a geothermal lease or an owner shall conduct his exploration, drilling, development, production operations, and disposal methods using all reasonable precautions to protect the environment and to prevent pollution of state waters, other environmental damages, or waste of geothermal resources."

Order No. 29-B -- Statewide Order Governing the Drilling for and Producing of Oil and Gas in the State of Louisiana --

So far as is known, Louisiana has not yet promulgated regulations for geothermal/geopressure operations, but the above order governs the disposition of salt water. This is generally to be handled through injection into subsurface formations not productive of hydrocarbons. However, it may be disposed of in state-approved pits; into tidally affected water, brackish waters, or any other waters unsuitable for human consumption or agricultural purposes; or into hydrocarbon zones under certain approved conditions.

Montana

Montana Geothermal Rules and Regulations --

These regulations apply only to geothermal leases on state lands and are administered by the Department of State Lands. Lessees are required to use all reasonable means to prevent waste, damage to any natural resource, and any environmental pollution or damage. These methods are to be described in a plan of operations submitted prior to drilling wells 305 m (1,000 ft) or deeper. Such measures must cover prevention or control of fires, soil erosion, pollution of surface and groundwater, damage to fish and wildlife, air and noise pollution, and hazards to public health and safety. When wells are abandoned, interzonal migration of fluid is to be blocked so as to prevent contamination of waters and protect life, health, environment, and property. Specific plugging requirements are spelled out.

Operators of wells in high pressure areas or in areas where the pressures are unknown are required to equip wells "with casings of sufficient strength seated in competent rock formation and cemented in place with such other safety devices as may be necessary . . . and use every reasonable effort to prevent blowout, explosions, and fires . . ."

## Nevada

Sections 2-5, Title 48 of Nevada Revised Statutes --
This legislation authorizes the state engineer to adopt regulations to insure the proper development, control, and conservation of the state's geothermal resources. The regulations, which have not yet been issued, may establish procedures to prevent pollution and waste.

## New Mexico

Rules and Regulations, Geothermal Resources --
These regulations, adopted pursuant to Chapter 75, Laws of 1973, are probably the most detailed of those reviewed in terms of drilling, production, casing, spacing, plugging, and report requirements, but among the least definitive in terms of environmental requirements.

Maximum protection of the environment is mandated; a drilling fluid pit of adequate size to provide sufficient fluid to confine natural fluids to their native strata and prevent blowouts is required to be constructed so as to prevent water pollution; noise abatement equipment as approved by the Oil Conservation Commission is required during drilling or production of wells within 457.5 m (1,500 ft) of a residence, school, or church; and highly mineralized waters are to be disposed of in such a manner that underground or surface waters are not contaminated.

## Oregon

Oregon Geothermal Regulations, Oregon Administrative Code--
Chapter 632, Sections 20-005-20-170 --
The 1971 Oregon Geothermal Resources Act authorized the State Department of Geology and Mineral Industries to control the discovery and production of geothermal resources. The regulations which the Department promulgated require lessees to use all reasonable means at their disposal to prevent damage to any natural resource including trees and other vegetation; fish, wildlife, and their habitat; or any environmental pollution or damage.

A log is required for geothermal wells which shows the character and depth of each formation encountered in the drilling of the well; the amount, size, and weight of casing used; the size, type, and depths of perforations; and the location, depth, and temperature of water-bearing strata, including temperature, chemical composition, and other chemical and physical characteristics of fluid encountered from time to time.

A blow-out prevention provision is included which is identical to that of the Montana regulations above. The method and degree of noise abatement will be prescribed by the State Geologist and must comply with the state noise regulations.

Casing regulations aimed at preventing the migration of formation fluids to other areas and directional drilling limitations similar to ones discussed above are set forth.

Specific plugging methods and abandonment procedures are applied as follows:

1. The hole shall be filled with an approved mud-laden fluid from bottom to top of the hole. At the top of each producing formation a cement plug shall be placed which extends either from the bottom of the hole or from a point 8 m (25 ft) below the top of each producing formation upward to a point at least 15.25 m (50 ft) above each producing formation.

2. A cement plug not less than 15.25 m (50 ft) in length shall be placed below all fresh water bearing strata.

3. A 6 m (20 ft) cement plug shall be placed at the top of the casing in each hole plugged in such a manner as not to interfere with soil cultivation and a steel plate welded over the casing stub.

Special conditions which apply to all deep well exploratory drilling in Oregon were outlined in a September 2, 1975, memorandum from the Director of the Department of Environmental Quality to the State Geologist. Perhaps its most significant feature is that the direct or indirect discharge of waste mud and wastewater to the waters of the state is prohibited. Discharge into self-contained, non-overflow holding pools is required instead. A permit is required for the discharge of geothermal, mineralized, or oil waters.

## Texas

Geothermal Resources Act --

This Act vested regulatory powers in the state Railroad Commission and leasing powers in the General Land Office.

The regulatory authority of the Railroad Commission extends to exploration, development, and production on all public and private lands. The General Land Office acts through the School Land Board to lease geothermal/geopressured resources on lands belonging to the Permanent School Fund of Texas (except wildlife refuges and recreational areas) and on its own to lease up to three leagues (10 1/2 miles) of offshore lands pursuant to the Submerged Lands Act (43 USC Sections 1301-1315).

The Commissioner of the General Land Office is required to incorporate in its leases the Railroad Commission's Conservation Rules for "conservation of the resource and protection of correlative rights." The School Land Board, however, has full discretion as to the terms and conditions of its lease and "may adopt rules and regulations" pertaining to all stages of development. This power seems total until read conjunctively with the mandate the Act confers on the Railroad Commission to protect the environment. However, the School Land Board's grant of "full authority" for lease conditions implies that the Railroad Commission's rules could be the minimal protection to be afforded to the environment. The Act does not make clear whether more stringent environmental controls could be imposed by the Land Office on a lessee than those established by the Railroad Commission. It should be noted that the Commissioner of the General Land Office is concurrently the Chairman of the School Land Board.

Rules and Regulations Governing Drilling and Producing on Permanent Free School Lands--

These regulations pertain only to oil and gas activities on surface lands and are not applicable to geothermal/geopressured lands. However, one provision which could be extended is notable. It imposes absolute liability upon a lease for any pollution arising from well activity and causing injury to private or public property.

General Land Office Rules and Regulations--

The General Land Office has not amended its rules to include geothermal/geopressured activity. However, rules and regulations pertaining to geological and geophysical exploration and surveys were issued by the agency in 1971 which do include geothermal development. These rules primarily set out the permitting procedure and the regulations for "shot" exploration.

Railroad Commission Rules and Regulations--

The Railroad Commission rules implement the Texas Geothermal Act. The majority of the 80 rules concern themselves more with the technological requirements for oil and gas operations than with the conservation of the environment or geothermal/geopressured operations, and represent the most comprehensive specific engineering and documentation requirements reviewed.

Environmental protection is aimed primarily at protecting the quality of Texas waters. Rule 8 states that fresh water, above or below the surface, shall be protected from pollution "whether in drilling, plugging, producing or disposing of salt water already produced." No operations may pollute "any stream or water course. . .or any subsurface waters." Salt water disposal pits are not to be used for storage and evaporation of geothermal resource waters nor are such resource waters allowed to be discharged into a dry or flowing creek or river without the commission's approval. The offshore and estuarine zones shall not be polluted or the aquatic life contained therein injured. The disposal of liquid wastes into these kinds of zones is limited to salt wastes and other materials which have had harmful or injurious constituents removed.

Rule 9 requires a permit for deep well injection of salt water. Nonproducing zones of oil, gas, or geothermal resources that contain mineralized water unfit for general use can be used for injection of salt water. These zones must not be attached to freshwater formations in order to avoid contamination of such formations.

Casing requirements for protection of fresh water sands that are or may be a source of fresh water are set in Rule 13. No environmental concerns are expressed.

Field rules that consider the conditions of a specific area of operation may be issued by the Commission after the first well has been completed.

## Utah

Rules and Regulations Governing the Issuance of Mineral Lease--

Provision for geothermal leases is made in Rule 30 of the above rules and regulations. They are issued by the Division of Lands, Department of Natural

Resources, only on lands where the State of Utah owns both the surface and mineral rights. Well permits are issued by the Division of Water Rights which is currently finalizing guidelines on this subject.

Environmental requirements are written into the lease itself rather than in the regulations. In the lease terms for development of the leasehold, the lessee is prohibited from discharging unconfined hot water, nonpotable water, or polluting substances upon the land surface or into the subsurface which will contaminate soil or water. This is a flat prohibition with no guidelines or alternatives offered.

In general provisions of the lease, the lessee is directed to comply with applicable federal and state air and water pollution regulations; to control noise as required by the State Lands Board or as required by state law; and to dispose of waste to protect wildlife, and to operate on archaeological or historical sites in accordance with directions from the State Land Board. In addition, the Land Board reserves the right to add such protective measures as it deems necessary on a case-by-case basis.

### Washington

Geothermal Resource Act--

The thrust of this act is to provide for the safe, orderly, and nearly pollution-free development of the state's geothermal resources. The definition of waste includes the escape of steam or hot water into the open air in excess of what is reasonably necessary in efficient development or production.

The Act preempts local regulation of the drilling and operation of geothermal wells -- the only instance of this found -- although the state is precluded from permitting operations where they would be prohibited under state or local land use laws or regulations.

Geothermal resources by-products and/or waste products escaping from an operation are subject to all state pollution control laws, state fisheries law, and the state game laws.

The Department of Natural Resources is given the authority to administer the act including the prevention of damage to underground and surface waters, land, or air that may result from improper drilling, operation, maintenance, or abandonment of geothermal resource wells.

### Wyoming

Wyoming Rules and Regulations Governing the Issuance of Geothermal Resource Permits and Leases--

Leases and prospecting permits are issued by the State Board of Land Commissioners. Permit and lease applications must describe the facility and use of underlying groundwaters and adjacent surface waters, and the proposed methods for disposing of liquid, solid, or gaseous wastes. In developing a lease or permit, operations must be carried on in a 'safe and workmanlike manner in accordance with generally accepted good engineering practices and due regard shall be given the protection of life and property, preservation of the environment, and the conservation of natural resources."

No geothermal well may be drilled without prior approval of the State Engineer. In obtaining a drilling permit, lessees or permittees must file notice of the location and elevation above sea level of the derrick, proposed depth, bottom hole location, casing program, proposed completion program, size and shape of the drilling site, excavation and grading planned, and location of existing and proposed access roads.

The Board of Land Commissioners upon recommendation of the State Engineer may determine the spacing of the well and rate of development and production. A safe and acceptable circulating medium is prescribed for all drilling operations. In effect, all activities and installations of generating plants, buildings, pipelines, etc., are subject to the prior approval of the Board and the State Engineer.

All drilling and production operations are required to be conducted in such a manner as to eliminate "as far as practicable" dust, noise, vibration, or noxious odors. Drilling mud is to be ponded in a safe manner and place until drilling is completed when it is to be disposed of, or after drying in place, covered with a protective layer of soil.

The Wyoming prospecting permit requires the permittee to obtain a permit pursuant to the Environmental Quality Act prior to any proposed waste discharge and to dispose of water or geothermal waste products in a manner that will not harm wildlife resources. Soil movement similarly must not result in degradation of waters, fish, and aquatic life habitat.

Permits and leases contain identical language dealing with subsidence which is shown in full in Appendix H. In brief, the Board may require the permittee or lessee to suspend all or any part of his operations within 30 days when it receives evidence of subsidence. The permittee or lessee is also obligated to notify the Board immediately of any evidence of subsidence.

## STATE NEPA-TYPE STATUTES AND REGULATIONS

Several states have enacted statutes which are analogous to the National Environmental Policy Act of 1969 as shown in Table V-3. Other states do not have a formal environmental impact review procedure, but cognizant state conservation or environmental agencies comment on proposed actions.

The California Environmental Quality Act of 1970 is probably as comprehensive as any existing state statute requiring the prior evaluation of the environmental impact of both public and private activities. Guidelines for implementing the Act have been promulgated which are even more comprehensive.

These two documents have been blamed for creating considerable delay in expansion of the Geysers operations in California. It is also contended that they are responsible for the fact that it may take from six months to over a year to obtain approval for even a one-well exploration project [11]. The complaints are not directed toward the goals of the Act per se, but to the administrative procedures involved in its implementation [12].

## TABLE V-3. STATE STATUTES AND REGULATIONS

### Environmental Impact

| | Statute | Some Form of Review | None |
|---|---|---|---|
| Alaska | | X | |
| Arizona | | X | |
| California | X | | |
| Colorado | | X | |
| Hawaii | X | | |
| Idaho | | | X |
| Louisiana | | | X |
| Montana | X | | |
| Nevada | X | | |
| New Mexico | | | X |
| Oregon | | X | |
| Texas | | X | |
| Utah | X[1] | | |
| Washington | X | | |
| Wyoming | | | X[2] |

[1] Executive Order of the Governor

[2] None affecting geothermal development

Because of the importance attached to the implementing guidelines and because they may be the forerunner of others to come, a very thorough summary is included here. The Act in its entirety is shown in Appendix I . A comparison of the guideline summary and the Act will provide a comprehensive view of the intent and effect of this legislation.

Summaries of the environmental impact evaluation requirements of other "geothermal" states follow the California discussion.

## California

Title 14, Natural Resources, California Administrative Code, Division 6, Chapter 3, Guidelines for Implementation of the California Environmental Quality Act of 1970--

These guidelines were promulgated by the Secretary pursuant to the Environmental Quality Act of 1970 (Public Resources Code Section 21000). They are to be followed by all state agencies, boards, and commissions, counties, cities, regional agencies, and all other subdivisions of the state. The guidelines are called the "State EIR Guidelines."

This document covers 52 printed pages. Its major functions are to establish the criteria by which it will be determined whether an EIR is required for a given project, which agency should take the lead role in preparing the EIR, directions for the preparation of various environmental documents (including the EIR) required by the Act, and instructions for interagency review and public participation. The major policy thrust is that the state government shall regulate the activities of private individuals, corporations, and public agencies in a manner which will prevent environmental damage. The definition of "project" which applies to geothermal activity is "the whole of an action which has a potential for physical impact on the environment, directly or ultimately" which involves "the issuance of a lease, permit, license, certificate, or other entitlement for use by one or more public agencies."

An environmental impact report is defined as a detailed statement setting forth the environmental effects and considerations pertaining to a given project as specified in the Act. This definition is discussed in more detail below.

Necessity for EIS--The only categorical exemptions from the preparation of an EIR are classes of projects which the Secretary for Resources has found do not have a significant effect on the environment. However, "ministerial" projects -- projects which legally must be approved upon a given statement of facts in a prescribed manner such as business licenses -- are also exempt. The other type of exempt activity is an "emergency" project which is one in which immediate action is necessary to prevent or mitigate loss or damage to life, health, property, or essential public service.

A "discretionary" project is an activity which requires the exercise of judgment, deliberation, or decision on the part of the agency with the responsibility to approve or disapprove a particular activity. This is distinguished from the above ministerial project, approval of which requires only a determination of conformity with applicable statutes, ordinances, or regulations.

Discretionary projects are first subject to an "initial study" or preliminary analysis to determine whether an EIR is required. If it is decided at this stage that the project would not have a significant effect on the environment, then a "negative declaration" is prepared presenting the reasons for this decision.

If any of the effects of a discretionary project may have a substantial adverse impact on the environment, then an EIR must be prepared regardless of whether the overall effect of the project is adverse or beneficial. Where there is a difference of opinion within an agency as to whether an effect is adverse or beneficial, an EIR is to be prepared to explore the point if there is, or there is anticipated to be, a substantial body of opinion which considers the effect adverse.

In evaluating the environmental significance of a project, both primary and secondary consequences must be considered. According to the definition of the guidelines, primary consequences are directly related to the project, and secondary effects are the consequences of the project -- i.e., a sewage treatment plant creates more growth (primary) and new growth impacts upon the resource base, including air, water, and energy use (secondary).

Projects are considered to have a potential for significant environmental effect when they include a change that:

1. Is in conflict with environmental plans and goals that have been adopted by the community where the project is to be located;

2. Has a substantial and demonstrable negative aesthetic effect;

3. Substantially affects a rare or endangered species of animal or plant, or habitat of such a species;

4. Causes substantial interference with the movement of any resident or migratory fish or wildlife species;

5. Breaches any published national, state, or local standards relating to solid waste or litter control;

6. Results in a substantial detrimental effect on air or water quality or on ambient noise levels for adjoining areas;

7. Involves the possibility of contaminating a public water supply system or adversely affecting groundwater;

8. Could cause substantial flooding, erosion, or siltation;

9. Could expose people or structures to major geologic hazards.

In every case where it is found that any of the following conditions will result from a project, the project shall be deemed to have impacts with a significant effect on the environment:

1. Impacts which have the potential to degrade the quality of the environment or curtail the range of the environment.

2. Impacts which achieve short-term gains to the disadvantage of long-term environmental goals.

3. Impacts of a project which are individually limited, but cumulatively considerable.

4. Environmental effects of a program which will cause substantial adverse effects on human beings, either directly or indirectly.

Geothermal activity becomes subject to the EIR requirement first by virtue of the fact that it is considered a discretionary project within the above definition, and, second, because certain of its operations could fall within the listed examples of change. The only avenue of exemption would be a negative declaration, on a case-by-case basis.

Only one EIR or negative declaration is required on a project and the actions of all responsible agencies must be governed by it. Where an EIR has been prepared on a project, no additional EIR is required unless there are substantial proposed changes which involve environmental impacts not considered in the intial EIR.

A single EIR may be employed to describe more than one project, if such projects are essentially the same in terms of environmental impact. Further, an earlier EIR prepared in connection with a previous project may be applied to a later project, if the circumstances of the projects are essentially the same. EIR's may be written in advance for entire programs or regulations, in order to prepare for project applications to come. Whenever these alternatives are utilized, however, the environmental effects of the projects must be similar enough to warrant the same treatment in an EIR, and the EIR must adequately cover the impacts of any single project. If these tests are not met, the EIR prepared for a program should be supplemented so that it applies to an individual project.

Where individual projects are, or a phased project is, to be undertaken and where the total undertaking comprises a project with significant environmental effect, a single EIR must be prepared for the ultimate project. Where an individual project is a necessary precedent for action on a larger project, or commits an agency to a larger project, an EIR must address itself to the scope of the larger project. One or the other of these situations was found to be the case in considering the impact of the most recent unit to be approved for The Geysers -- i.e., EIR's were required on both geothermal production and use. Where one project is one of several similar projects, but is not deemed a part of a larger undertaking or a larger project, either one EIR for all projects or one for each project may be prepared but in either case comment should be made upon the combined effect.

In cases where a project will require both a California EIR and an

Environmental Impact Statement (EIS) under the National Environmental Policy Act, the EIS may be used in lieu of the EIR if it complies with the state guidelines. If the EIS is used, discussion of mitigating measures and growth-inducing impact must be added or supplemented if the EIS discussion of these elements is inadequate.

The intent conveyed in the last several paragraphs does not appear to square with activities in the area of The Geysers where three levels of government -- federal, state, and local -- have studied the same area. In addition, a separate EIR has been required for every well [13] and 12 wells are needed for a 55 MW plant. It is reported [14] that all of the EIR's prepared for this proven area look alike.

Lead Agency--In many instances, including geothermal development, a project requires approval by more than one public agency. In this case, a "lead agency" is designated to take the principal responsibility for preparing environmental documents and for approving a project. All other agencies concerned must consider the Lead Agency's EIR or negative declaration before initiating their own action on the project.

In the case of nongovernmental activity, the Lead Agency is the public agency with the greatest responsibility for supervising or approving the project as a whole -- i.e., an agency with general governmental powers rather than an agency with a single or limited purpose. The counties have been acting as the Lead Agencies in geothermal drilling although the state Public Utilities Commission has jurisdiction over electric generation. This jurisdiction will pass to the new State Energy Resources Conservation and Development Commission. The counties' role is supported by the "jurisdiction of law" accorded to counties when they are the site of a project, the area in which the major environmental effects will occur, and/or the area in which the public most directly concerned with the environmental effects resides.

The Lead Agency is directed to consult with all other responsible agencies before completing its draft EIR or negative declaration, and subsequently to seek interagency review of its document and comment from persons with special expertise.

EIR Process--If, after its initial study, the Lead Agency finds that the proposed project may have a significant effect on the environment, the Lead Agency must prepare an EIR or have one prepared by an outside contractor or by an applicant. In either case, the agency is entirely responsible for its adequacy and objectivity. A Lead Agency is authorized to collect a reasonable fee to defray its own costs for preparing an EIR or negative declaration when the project requiring one is proposed by an applicant outside the agency -- i.e., an applicant is required to pay the cost of a contractor.

If the Lead Agency prepared either an EIR or negative declaration or has it done by a contractor, the agency may require the applicant to furnish all necessary data and information. As noted above, if this takes the form of a draft EIR, it must be reviewed and amended as needed so that it reflects the independent judgment of the Lead Agency.

Only the highlights of the mandated contents of an EIS are summarized briefly here. The reader who requires more detail is referred to Article 9, Title 14.

The precise location and boundaries of the proposed project are to be shown both on a detailed map and on a regional map. The project's objective and technical, economic, and environmental characteristics must also be stated. However, it is noted that extensive detail beyond that needed for evaluation and review of the environmental impact is not necessary.

The local and regional environmental setting of the proposed project must be described with emphasis on resources rare or unique to the region and with specific reference to related projects which might engender a cumulative impact. The following aspects of environmental impact must be specifically addressed:

1. Direct and indirect
2. Short-term and long-term
3. Specifics of the area
4. Resources involved
5. Physical changes
6. Alterations to ecological systems
7. Changes in population distribution and concentration (commercial and residential)
8. Changes in water and scenic quality and public services

Adverse environmental impacts must be described including those which can be reduced, but not eliminated, along with reasons for proposing the project, its effects notwithstanding. Measures to mitigate adverse effects and alternatives where available are to be outlined including identification of the levels of reduction.

Alternatives to the project itself or its location must be described including those which would substantially impede project objectives and are more costly. The specific alternative of "no project" and its impact must always be evaluated. Any irreversible environmental changes such as use of non-renewable resources and growth-inducing impacts must also be discussed.

Water quality aspects of the proposed project, including those which have been previously certified by the appropriate state or interstate agency as being in substantial compliance with applicable water quality standards, must be specifically described.

When the draft EIR is completed the Lead Agency must consult with and obtain comments from public agencies with jurisdiction by law with respect to the proposed project and should consult with special relevant expertise. In addition, an opportunity for comment by the general public should be provided, and public hearings may by held. (Underlining is added for emphasis on the precise connotation of each of these terms. According to Section 15015 of the guidelines, "must" identifies a mandatory element; "should" implies policy considerations and means that the action should be taken in the absence of compelling, countervailing considerations; and "may" identifies a permissive element which is left fully to the discretion of the public agencies involved. There is a major distinction here as discussed below under "Public Participation.")

The Lead Agency then must evaluate the comments of all reviewers and prepare the final EIR. The final document contains the draft EIR or a revision; comments and recommendations received or a summary thereof; a list of reviewers; and the responses of the Lead Agency to significant environmental points raised. If a project is approved a Notice of Determination is filed. Each responsible agency shall consider the Lead Agency's final EIR before acting upon or approving the subject project.

Timing of EIR Procedures--Several statements regarding the timing of implementing EIR requirements are noteworthy. The first of these is that public agencies should carry out their responsibilities for preparing and reviewing EIR's within a reasonable period of time. Further, Section 15054 states that the requirements for the preparation of an EIR should not cause undue delays in the processing of applications for permits or other entitlements to use. (Emphasis added.)

Despite provisions such as this, delays have been a common problem in the environmental assessment procedure generally and are not confined to California. They are typified, however, by the fact that it took 38 months from the date of application to complete a final EIR on a recent unit at The Geysers. This compares with an average of 5.3 months for the whole permit procedure for earlier units [15]. This situation suggests that the language of the guidelines may not be the real culprit -- i.e., the major delay may be a "people" problem, both in the public sector in its participatory role and in the implementation of the guidelines.

Section 15160 requires that the Lead Agency provide adequate time for review of an EIR by other agencies and the public. Review periods of not less than 30 nor more than 90 days except in unusual circumstances are suggested for draft EIR's. It is noted specifically, however, that a review period of an EIR does not require a halt in other planning activities related to a project. (Emphasis added.) Planning should continue in conjunction with an environmental evaluation.

If a reviewer (agency or person) fails to comment within a reasonable time as specified by the Lead Agency and does not seek an extension, it shall be assumed that the agency or person has no comment to make.

Public Participation--While public hearings are not made mandatory as discussed above, and are not required by the Environmental Quality Act of 1970, the guidelines stress that wide public involvement, both formal and informal, is a desirable goal. All agencies should make provision for such procedure in order to properly review and evaluate public reactions, adverse and favorable, based on environmental issues. No timeframe is suggested.

## Alaska

The Department of Environmental Conservation reviews and comments on projects that may potentially affect the state's environment. The state has no environmental impact act.

## Arizona

"Requirements for Environmental Impact Statements" are followed by the Arizona Fish and Game Commission in the preparation of an EIS. Essentially, the outline is a reiteration of the major category headings of the Council on Environmental Quality (CEQ) EIS guidelines such as "Alternatives to the Proposed Action."

## Colorado

A sunshine law in Colorado enables the public to attend and comment on any state action, including geothermal leasing. No environmental quality act has been enacted.

## Hawaii

In 1974, Hawaii established its Environmental Quality Commission (Chapter 343, Hawaii Revised Statutes) and enacted an Environmental Policy Act (Chapter 344 of the Statutes). An environmental impact statement is required if an action would have significant effects and utilize state or county funds or lands. This is particularly applicable to lands in a conservation district as specified by the State Land Use Commission; lands within the shoreline area or within 300 feet seaward of the shoreline area; lands within any historic site as designated in the National or Hawaii Register or the Hawaii Revised Statutes; and lands within the Waikiki-Diamond Head area of Oahu. The agency with initial jurisdiction over a proposed action must make threshold determinations and then submit a request for an EIS to the Commission. If the Commision then determines that an EIS is needed, the EIS is prepared and reviewed by the public. The governor or the mayor of the county involved then makes a final determination as to the environmental acceptability of the proposed action.

If both NEPA and the state's act apply, the draft statement has to be submitted to the Hawaii Environmental Quality Commission 30 days prior to submission to CEQ. The final impact statement also is reviewed and approved by the Commission. Feasibility or planning studies are exempted from the EIS requirement.

No formal regulations have yet been issued.

## Idaho and Louisiana

No environmental impact requirements.

## Montana

The State Department of Health and Environmental Sciences Regulations 16-2.2(2)-P2000 through P2080 implement Chapter 65, Title 69, of the Montana Environmental Policy Act. A policy statement preceding the MEPA rules requires that the state Board of Health and Environmental Sciences and Department of Health and Environmental Sciences conform to the procedures established in the rules prior to finalization of their decisions.

Environmental impact statements are to be prepared on proposals for projects, programs, legislation, and other major actions of state government significantly affecting the human environment. The following criteria normally require the preparation of an EIS:

1. The action may significantly affect environmental attributes recognized as being endangered, fragile, or in severely short supply.

2. The action may be either significantly growth-inducing or growth-inhibiting.

3. The action may substantially alter environmental conditions in terms of quality or availability.

The steps of EIS preparation and review procedures allowed for are very similar in objectives to the California guidelines described in detail above.

## Nevada

No environmental guidelines have been issued pursuant to Chapter 311 of 58 Nevada Revised Statute Laws of 1971.

## New Mexico

In 1973, the state suspended its Environmental Quality Act of 1971 in order for the legislature to enact a new environmental policy act. To date, no such action has occurred.

## Oregon

Oregon has no environmental impact legislation. However, the Department of Environmental Quality may "advise, consult, and cooperate" with other agencies in matters pertaining to protection and enhancement of Oregon's environment.

## Texas

The Interagency Council on Natural Resources and the Environment published the Texas "Policy on the Environment" in 1972. This Policy plus guidelines and procedures are all contained in the "Environment for Tomorrow: The Texas Response" prepared by the Division of Planning Coordination, Office of the Governor, January 1, 1973. The policy solicits interagency cooperation and review of participants in order to minimize the environmental effects of a proposed activity and to develop alternatives that would abate environmental problems.

## Utah

Each state agency within Utah is required, via an Executive Order issued

August 27, 1974, by the Governor, to issue an EIS for every state action it proposes or is administratively responsible for. An Environmental Coordinating Committee ("ECC") was established to advise, oversee, and review environmental impact statements by the relevant state agencies. The ECC's comments and determination as to the significance of the impacts are then forwarded to the Economic and Physical Development Interdepartmental Coordination Group, which will then repeat the procedure followed by the ECC. The Governor is then informed of these determinations and approves or rejects the findings. The proposing state agency is responsible for any EIS preparation and for submission of said document to the above-mentioned parties. "Significant" includes impact for mineral resource development, from archaeological impairment, or any environmental factors deemed to be important by a public agency. Private party actions are exempt unless a state agency is involved in licensing or funding.

### Washington

The Environmental Policy Act of 1971 (Revised Code of Washington, Chapter 43.2C (Suppl. 1973) was enacted and amended with Chapter 179 of the Laws in 1974. The "Guidelines for Implementation of the State Environmental Policy Act of 1971" are presently being revised.

All branches of the state government, including municipal corporations, fall within the jurisdictions of the Act. If a government agency takes action with respect to a private or state party and the action is major and significantly affects the quality of the environment, an environmental impact statement has to be prepared.

The guidelines are essentially the same as those promulgated by CEQ. All policies and laws of the State are to be administered in accordance with the Environmental Policy Act. Separate agencies are requested to issue internal guidelines so as to facilitate the environmental review process. Threshold decisions are required for determination of whether an EIS is necessary. The Washington Council on Environmental Quality oversees the implementation and enforcement of the Act.

The Shoreline Management Act (Chapter 286, Laws of 1971) can necessitate preparation of an EIS if the environment of the shore would be impacted adversely. There are no specific EIS requirements, yet the permitting process is used to evaluate environmental impacts.

### Wyoming

The Environmental Quality Act of 1973, as amended in 1974 and 1975 (Ch. 250, Section 1, 1973 Laws), is general and applies to mining activities that do not, by definition, include geothermal resource development.

## AIR POLLUTION

A review of the air pollution regulations of 14 states and four counties in California with known geothermal resources has substantiated the fact that many of their provisions are similar to each other and identical in some cases.

There are several reasons for this. In addition to the degree of uniformity engendered by federal requirements, states have adopted model provisions drafted by various organizations other than EPA and its predecessors. Another reason is the proclivity of jurisdictions to adopt the environmental controls of another. Much of the language in general air pollution usage today derived from the Los Angeles County regulations where regulation of this type began. Thus, it was not surprising to find that the many state documents reviewed lend themselves to a large degree to general summaries applicable to all, with individual summaries limited to those areas of individual interest.

This similarity also points to the conclusion that potential geothermal developers are not likely to find a state which is an air pollution control "haven," so to speak, at least insofar as the language and numerous limitations of the regulations are concerned. The history of environmental regulation indicates very strongly that what one state imposes today may very well be adopted by another tomorrow as suggested above.

The summaries do not dwell on those provisions of air pollution regulation which are more general in nature. Procedures, as such, are omitted, including hearing procedures. Hearings are provided for by most states and the federal government at almost any point in the regulatory process when they are in the interest of the operator and/or the public. This assurance is virtually guaranteed by the NEPA-type process.

## Permits

All states require some form of permit for the construction, modification, and operation of sources or potential sources of air pollution. In addition, sources existing at the time the regulations are promulgated are often subject to a registration system which serves essentially the same purpose as the permit for a new or modified source. Whatever the nomenclature, the requirements are very similar.

The information required is quite comprehensive. It may include any or all of the following: a description of the production processes and related flow chart; a plot plan showing the height and location of all air contaminant sources and location of the nearest residential or commercial property; type and quantity of fuels used; amount, nature, and duration of emissions; estimated efficiency of control equipment under present or anticipated operating conditions; evidence that the emissions will not cause the national ambient air standards or NSPS to be exceeded, or, alternatively, an abatement schedule which will bring emissions into compliance; evidence that the proposed facility will not cause significant deterioration of existing air quality in specified areas; evidence that it is located in accordance with official land use planning; certification that it will utilize the best available control technology; and installation of monitoring equipment.

Some of these requirements could be far less innocuous for potential geothermal operators than for established industries because of the unknowns, or at least uncertainties, surrounding several of the facts which must be provided. Emission character and control equipment efficiencies will be particularly difficult to forecast due to lack of experience.

## Variances

Variances from air pollution regulatory requirements are provided for in most of the regulations reviewed, although it was noted that this is not the case in those of Alaska and Arizona. Requests for variances are generally on the basis that compliance with a given requirement or requirements would cause an unreasonable hardship. This claim must be factually supported. The control agency then must determine the relative advantages and disadvantages to the public of the proposed variance vs. an order for compliance.

## Particulate Standards

A survey of the particulate emission standards of geothermal states shows a great deal of similarity in approach although some variance in stringency. Nine of the states and some California Air Pollution Control Districts (APCD) base a particulate emission limitation which would be applicable to geothermal power plants on process weight per hour. In most cases, "process weight" means the total weight of all materials introduced into a specific process which may cause particulate emissions. The State of Wyoming, however, has excluded "the weight of any water, water vapor, or steam." Equations are furnished for calculating maximum emission rates for process industries with a process weight of 60,000 pounds per hour or less and for those with a process weight greater than 60,000 pounds per hour. In the less stringent regulation used by six western states and Louisiana, the equations are as follows for the smaller and larger processes respectively:

$E = 4.10\ P^{0.67}$ (smaller)

$E = 55.0\ P^{0.11} - 40$ (larger)

where: E = the maximum allowable particulate emissions rate in kilograms (pounds)-mass per hour; and P = the process weight rate in kkg (tons)-mass per hour.

What this works out to is an emission rate of approximately 1.23 kg (2.75 lb) of particulate matter for the first 450 kg (1,000 lb) of process weight per hour ranging up to 31 kg (69 lb) at 450,000 kg (1,000,000 lb) process weight per hour. This standard is employed in Idaho, Nevada, Montana, Oregon, for existing sources in Wyoming, and Arizona for areas outside Phoenix and Tucson. It is also used in the APCD's in which Lake, Mendocino, Sonoma, and Imperial Counties are located in California although there is some variation in application -- for example, in the Northern Sonoma County regulations the equation shown here for use with the small process weight (60,000 pounds per hour or less) is applicable for all weights.

For Phoenix/Tucson in Arizona, new sources in Wyoming, and in Colorado, the equations become more stringent as follows:

$E = 3.59\ P^{0.62}$

$E = 17.31\ P^{0.16}$

The hourly emission rate then drops to about 2.25 and 46.72 pounds per hour, respectively, for the smaller and larger sources, discussed above. The Texas regulation is considerably more lenient than those derived by either of the above sets of equations for facilities with certain stack heights, although the allowable emission is reduced if the height is less than specified.

Other states impose a particulate emission standard based on grains per standard cubic foot of dry exhaust gas. In Washington state, the standard is 0.1 grains. Alaska applies 0.05 grains to new sources and 0.15 to existing sources.

The State of Utah simply requires 85 percent control of particulate emissions with no control as a base.

Another form of particulate control is a limitation on the darkness or opacity of a plume. The limit in most of the states surveyed is No. 1 Ringelmann, although a few apply this only to new sources and permit up to No. 2 for existing sources. Since smoke is not a factor in geothermal operations, opacity is the controlling interest. However, in many cases, when opacity exceeds the standard because of the presence of uncombined water or condensing water vapor, this is not a violation. Some states, such as Nevada and Washington, put the burden of proof on the operator and others do not.

The ambient air standards for particulate matter reviewed are rather stringent in that most of them utilize the federal secondary standard rather than the primary one. This is 60 $\mu g/m^3$ as an annual geometric mean and a maximum 24-hour concentration of 150 $\mu g/m^3$ not to be exceeded more than once per year. By 1980, Colorado will impose a 24-hour limit of 45 $\mu g/m^3$ statewide. Montana adopted the federal primary 24-hour standard of 75 $\mu g/m^3$ but a lower annual mean of 200 $\mu g/m^3$ as opposed to 260 in the federal primary standard. The Idaho regulations embrace both the primary and secondary standards and apply them to all areas of the state outside a property line. The federal Clean Air Act requires states to attain the primary standards within three years after their implementation plan is approved and to achieve the secondary standard within a "reasonable time." The state regulations do not establish time frames.

Still another type of particulate control which will be of concern during the site preparation and drilling phases of geothermal development is the control of fugitive dust. Nearly all states require use, where possible, of water or chemicals for control of dust during the clearing of land, construction operations, and grading of roads. There are also various specific requirements for gravel use and paving and some numerical limits on dustfall. It is not necessary to spell out each of these here because, while they may constitute what an operator considers a nuisance in the series of environmental controls he finds he must undertake, there are no such requirements which could conceivably affect the pace of geothermal development.

## Sulfur Dioxide Standards

Sulfur dioxide standards are variously expressed in parts per million (ppm), a volume-to-volume measurement, and micrograms per cubic meter ($\mu gm^3$), a weight-to-volume value. In the following discussion, standards promulgated in ppm are converted to $\mu g/m^3$, and vice versa. The reference conditions assumed for the conversions are those upon which the federal $SO_2$ ambient air standards are based -- 25°C (77°F) and 760 mm of mercury (14.7 psi). These precise values are not uniformly used by all states as standard conditions -- for example, 21°C (70°F) and 15.6°C (60°F) are used by Alaska and Arizona, respectively, so some conversions are approximate only, although close enough for the comparative purposes of this report.

In several of the states surveyed there are no emission standards on sulfur oxides which could be interpreted as applicable to geothermal production or use. This is because the emission standards for this pollutant are geared strictly to combustion of fuel or to other specific industries. No applicable $SO_2$ emission standard was found in Idaho, Montana, New Mexico, Oregon, or Wyoming. Utah simply requires new installations with a potential for emitting sulfur compounds to avoid exceeding the national primary and secondary ambient air standards and new source performance standards and existing installations to control sulfur emissions in such a manner that the standards shall never be exceeded.

Colorado presently places a 1,333,500 $\mu g/m^3$ (500 ppm) $SO_2$ emission limit on existing process units, and new sources are limited to 1,333,500 $\mu g/m^3$ (500 ppm) with a 4.5 kkg (five ton) per day maximum emission. The latter will be applied to existing sources in 1978. Either type of source is exempt if the emissions are at 400,050 $\mu g/m^3$ (150 ppm) $SO^2$ or below. The Colorado sulfur standard includes all oxidized forms of sulfur including sulfuric acid mist, such as that experienced in the vicinity of The Geysers. The Washington state emission limit is 2,667,000 $\mu g/m^3$ (1,000 ppm) as is that of Lake and Sonoma Counties, California. Louisiana has continued a 5,334,000 $\mu gm/^3$ (2,000 ppm) limit.

The Nevada sulfur emission standard is somewhat more complex and reads as follows:

> "No person shall cause, suffer, allow, or permit the emission of sulfur compounds where the sulfur originates in the material being processed (excluding sulfur from all solid, liquid, or gaseous fuel), in excess of the quantity determined by the following equation:
>
> $E = 0.271 P^{0.904} (0.292 P^{0.904})$
>
> when E is equal to or greater than 5 kg (11 lb) per hour.
>
> Where: E is the allowable sulfur emission in kilograms (pounds) per hour.
> P is the total feed sulfur in kilograms (pounds) per hour."

In Arizona, reduced sulfur emissions -- including sulfur dioxide, sulfur trioxide, and sulfuric acid -- are limited to 10 percent of the sulfur entering the process as feed.

In Mendocino County, California, there are $SO_2$ emission standards based on ground-level measurement. The limits are 5,334 $\mu g/m^3$ (2.0 ppm) at any time, 107 μg/m$^3$ (0.04 ppm) for a 24-hour average, and 1,333 μg/m$^3$ (0.5 ppm) for a one-hour average.

The Northern Sonoma County regulations place limits on sulfur emissions from sulfur recovery units producing elemental sulfur. These are:

1. 800,100 μg/m$^3$ (300 ppm) by volume of sulfur compounds calculated as $SO_2$
2. 714,000 μg/m$^3$ (10 ppm) by volume of $H_2S$
3. 90.8 kg (200 lb)/hr of sulfur compounds calculated as $SO_2$

Discharges containing less than 4.5 kg (10 lb) per hour may be diluted to meet the standard. In Imperial County, emissions of sulfur compounds calculated as $SO_2$ are prohibited in excess of 0.2 percent by volume.

In some cases, the state ambient air standards for sulfur oxide are somewhat more restrictive than the federal standards which are:

Primary
Annual arithmetic mean - 80 μg/m$^3$ (0.03 ppm)
Maximum 24-hour concentration - 365 μg/m$^3$ (0.14 ppm)

Secondary
Maximum 3-hour concentration - 1,300 μg/m$^3$ (0.50 ppm)

Colorado, Nevada, Oregon, and Wyoming have reduced the annual mean to 60 μgm/$^3$ (0.02 ppm), some of the others are slightly lower than the federal primary standard, and others went along with the above values. Hawaii is by far the most restrictive with a mean limitation of 20 μg/m$^3$ (.008 ppm) and a 24-hour peak maximum of 80 μg/m$^3$ (0.03 ppm).

## Hydrogen Sulfide Standards

Four of the 15 states covered by this report have a hydrogen sulfide ambient air standard, two have promulgated $H_2S$ emission standards, and three others have some type of standard on total reduced sulfur (TRS) compounds which could impact geothermal operations. All of these standards are set forth in the footnotes of Table V-4.

## Hydrocarbon Standards

The federal primary and secondary ambient air standard for hydrocarbons, measured and corrected for methane by a method set forth in an appendix to 40 CFR Part 50, is: 160 μg/m$^3$ (0.24 ppm) maximum three-hour concentration (6 to 9 a.m.) not to be exceeded more than once per year. Only two states were found to have lower limitations -- New Mexico at 0.19 ppm and Hawaii at 100 μg/m$^3$.

## Nitrogen Dioxide Standards

TABLE V-4. STATE $H_2S$ STANDARDS APPLICABLE TO GEOTHERMAL DEVELOPMENT*

| | Ambient Air | Emission | TRS[1] |
|---|---|---|---|
| Alaska | - | - | 2 |
| Arizona | - | - | 3 |
| California | 4 | - | - |
| Colorado | - | - | - |
| Hawaii | - | - | - |
| Idaho | - | - | - |
| Louisiana | - | - | - |
| Montana | 5 | - | - |
| Nevada | - | 6 | - |
| New Mexico | 7 | - | 8 |
| Oregon | - | - | - |
| Texas | - | 9 | - |
| Utah | - | - | - |
| Washington | - | - | - |
| Wyoming | 10 | - | - |

---

*Some $H_2S$ standards are expressed in ppm and some in $\mu g/m^3$. In order to convert one to the other for the benefit of comparison, standard conditions of 25°C (77°F) and 76 mm of Hg are assumed, although these values are not uniform throughout all state standards. Therefore, the conversions are approximate.

[1] Total Reduced Sulfur - includes some combination of hydrogen sulfide, mercaptans, dimethyl sulfide, dimethyl disulfide, or other organic sulfides. No effort is made to convert ppm to $\mu g/m^3$ or vice versa because of the wide variation in substances which may comprise TRS.

[2] 50 $\mu g/m^3$, 1/2-hr. max. not to be exceeded more than once/yr.

[3] Reduced sulfur emissions including but not limited to $SO_2$, $SO_3$, and $H_2SO_4$ shall not exceed 10% of the sulfur entering the process as fuel.

[4] Less than 42 $\mu g/m^3$ (0.03 ppm) as max. 1-hr. av.

[5] 70 $\mu g/m^3$ (0.05 ppm), 1/2-hr. av. not to be exceeded more than twice/yr.; 42 $\mu g/m^3$ (0.03 ppm) 1/2-hr. av. not to be exceeded more than twice/5 consecutive days.

Continued

TABLE V-4 (Continued)

[6] Emission of sulfur compounds where the sulfur originates in the material being processed (excluding sulfur from all solid, liquid, or gaseous fuel), may not exceed the quantity determined by the following equation:

$E = 0.271\ P^{0.904} \quad (0.292\ P^{0.904})$

when "E" is equal to or greater than 5 kilograms (10 pounds) per hour.

Where:

"E" is the allowable sulfur emission in kilograms (pounds) per hour.
"E" is the total feed sulfur in kilograms (pounds) per hour.

When "E" is less than 5 kilograms (10 pounds) per hour, the gas stream concentration shall not exceed 1,000 ppm by volume.

[7] 0.003 ppm, 1-hr. av. (for the state except the Pecos-Permian Basin Intrastate Air Quality Control Region)

0.100 ppm, 1/2-hr. av. (for the Pecos-Permian Basin Intrastate AQCR)

0.030 ppm, 1/2-hr. av. (after 1/1/76, for within corporate limits of municipalities within the Pecos-Permian Basin Intrastate AQCR)

0.030 ppm, 1/2-hr. av. (after 1/1/78, for within 5 miles of the corporate limits of municipalities with a population greater than 20,000 and within the Pecos-Permian Basin Intrastate AQCR)

[8] 0.003 ppm, 1-hr. av. (for the state except the Pecos-Permian Basin Intrastate AQCR including $H_2S$)

0.010, 1/2-hr. av. (for the Pecos-Permian Basin Intrastate AQCR, except for $H_2S$)

0.003 ppm, 1/2-hr. av. (after 1/1/76, for within corporate limits of municipalities within the Pecos-Permian Basin Intrastate AQCR, except for $H_2S$)

0.003 ppm, 1/2-hr. av. (after 1/1/78 for within 5 miles of the corporate limits of municipalities with a population greater than 20,000 and within the Pecos-Permian Basin Intrastate AQCR, except for $H_2S$)

[9] Emissions of $H_2S$ from a source or sources operated on a property or multiple sources operated on contiguous properties may not exceed a net ground level concentration of 112 $\mu g/m^3$ (0.08) averaged over

Continued

TABLE V-4 (Continued)

any 30-minute period if the downwind concentration of $H_2S$ affects a property used for residential, business, or commercial purposes.

Emissions of $H_2S$ from a source or sources operated on a property or multiple sources operated on contiguous properties may not exceed a net ground level concentration of 168 μg/$m^3$ (0.12 ppm) averaged over any 30-minute period if the downwind concentration of $H_2S$ affects only property used for other than residential, recreational, business or commercial purposes, such as industrial property and vacant tracts and range lands not normally occupied by people. (See Appendix J for procedures for determining net ground level concentrations.)

[10] 70 μg/$m^3$ (0.05 ppm), 1/2-hr. av. not to be exceeded more than twice/yr; 40 μg/$m^3$ (0.03 ppm) 1/2-hr. av. not to be exceeded more than twice/5 consecutive days.

The federal primary and secondary ambient air quality standard for nitrogen dioxide is 100 $\mu g/m^3$.

## Odors

Odor regulations range from none at all, to non-specific ones, to the very stringent ones of Montana described earlier. The Idaho regulations contain an example of the non-specific type which it applies to all sources for which no other gaseous emission control regulations apply. It states:

> "No person shall allow, suffer, cause, or permit the emission of odorous gases, liquids or solids into the atmosphere in such quantities as to cause air pollution."

In others, prohibited odor is defined as one which is still detectable after a certain number of dilutions with odor free air as determined by a scentometer or equivalent device. In the Wyoming regulations and those of Colorado applicable to residential and commercial areas, the number of dilutions is seven; in Nevada, it is eight. In Colorado, 15 dilutions are permitted in areas other than residential or commercial, and when the source of odor is a manufacturing process, the dilutions go up to 127. Frequently, the proviso is added to this type of regulation that two odor measurements within one hour separated by at least 15 minutes are necessary before the odor occurrence is considered a violation.

## Air Pollution Episodes

The Clean Air Act requires the states to adopt plans for action when air pollution reaches levels determined to require an alert, a warning, or to constitute an emergency situation. Because of the more remote location of most geothermal resources, it is not anticipated that development of them will become a major contributor to such situations in the foreseeable future. Nor are production and use operations likely to be affected by them.

The brief descriptions of air pollution control requirements by state which follow are not intended to summarize entire sets of regulations. Instead, they point up interesting facets of regulations not included in the above summaries or set forth unusual provisions not found in the others. A list of air pollution control statutes and regulations for the 15 states subject to this report are shown in Table V-5. Implementing agencies are listed in Table V-2.

## Alaska

Air pollution control in Alaska is authorized by Title 46, Alaska Statutes, Water, Air, and Environmental Conservation; the Department of Environmental Conservation is given implementing authority. Local air pollution control program requirements must be compatible with those of the state. In the absence of a municipal program or by reason of a deficient program, the state's air pollution program supersedes the local ordinances, regulations, and requirements. The Department may retain control of a particular class of air contaminant source because (1) its complexity or magnitude is beyond the reasonable capability of local control authorities; or (2) it may be more efficiently and economically controlled at the state level.

The state has emergency powers to force immediate discontinuance of any activity which in the judgment of the Commissioner of the Department of Envi-

## TABLE V-5. STATE STATUTES AND REGULATIONS
### Air Pollution Control

| State | Statute | Regulation |
|---|---|---|
| Alaska | Title 46, Alaska Statutes, Water, Air, and Enviornmental Conservation. | Title 18, Environmental Conservation, Chapter 50, Air Quality Control Alaska Administrative Code |
| Arizona | A.R.S., Air Pollution Control Laws Titles 28 and 36 | Rules and Regulations for Air Pollution Control, Chapter 3, Articles 1-12 |
| California | Recodification of California Air Pollution Control Laws, Chapter 957, Statutes of 1975 | |
| Colorado | Air Pollution Control Act of 1970, Chapter 64, Colorado Session laws 1970 | Air Pollution Control Regulations No. 1-9; Common Provisions Regulation; Ambient Air Standards for Metropolitan Denver AQCR, State Air Pollution Control Areas, and the State of Colorado. |
| Hawaii | Environmental Conserva-Laws and Regulations Vol. 1, Part II, Air Pollution, as amended | Air Pollution Regulations, Environmental Laws and Regulations, Vol. II. |
| Idaho | Air Pollution Control Act, as amended, Idaho Code Title 39, Chapter 29 | Rules and Regulations for the Control of Air Pollution in Idaho |
| Louisiana | Air Control Law, Act 1964 No. 259 | Regulations, Air Control Commission |
| Montana | Clear Air Act of Montana | Air Quality Rules |
| Nevada | Nevada Revised Statutes | Air Quality Regulations |
| New Mexico | Air Quality Control Act, Chapter 277, Laws of 1967, as amended | Air Quality Control Regulations |
| Oregon | Oregon Air Pollution Control Laws, ORS of 1969, Chapter 468 | Chapter 340, Oregon Administrative Rules Compilation, Division 2, Air Pollution Control |
| Texas | Clean Air Act, codified as Article 4477.5 | Air Control Board General Rules and Regulations |
| Utah | Air Conservation Act, 26-15-4 and 26-24-5, Utah Code Annotated, 1953, as amended | Air Conservation Regulations |
| Washington | Clean Air Act, Chapter 70.94, RCW | General Regulations for Air Pollution Sources, Chapter 18-04, WAC, and miscellaneous specific rules and regulations |
| Wyoming | Chapter 9.1, Articles 1-11, Wyoming Statutes, 1973 Cumulative Supplement | Air Quality Standards and Regulations |

ronmental Conservation presents an imminent or present danger to the health or welfare or would be likely to result in irreversible or irreparable damage to natural resources or the environment.

Title 18, Chapter 50, Alaska Administrative Code, Air Quality Control--

In addition to the ambient air quality standard for reduced sulfur compounds shown in Table V-4, there is an emission standard for this class of pollutants, expressed as $H_2S$ on a dry basis, relating to such compounds emanating from kraft pulp mills. However, there is presently no $H_2S$ emission standard applicable to other types of sources. This point is interesting here only to point up the fact that Alaska has prepared this kind of regulation in advance to meet the eventuality of kraft pulp mills, of which it presently has none, and that the same precaution has not been extended to potential geothermal operations.

The Department may require a special permit for new industrial facilities in areas of potential ice fog and the reduction of water emissions.

## Arizona

The Arizona Department of Health Services is given authority to control air pollution in the state by Section 36-1707 and 36-1717 of the Arizona Revised Statutes. The Department issued the following regulations on October 1, 1975.

Arizona Rules and Regulations for Air Pollution Control--

In addition to its ambient air quality standards for the six pollutants enumerated previously, Arizona's regulations set forth air quality goals for ultimate achievement on four of them. No target date is suggested for the goals. The concentration limits of the goals compare with the standards as follows:

| Non-Specific Particulate Standard | Goal |
|---|---|
| Maximum 24-hour arithmetic average-150 μg/m$^3$ | Maximum 24-hour average-100 μg/m$^3$ |
| Non-Methane Hydrocarbons Standard | Goal |
| 3-hour average (6 - 9 a.m.) - 160 μg/m$^3$ | 3-hour average (6 - 9 a.m.) - 80 μg/m$^3$ |
| Carbon Monoxide Standard | Goal |
| 1-hour average - 40 mg/m$^3$ | |
| 8-hour average - 10 mg/m$^3$ | 8-hour average - 7 mg/m$^3$ |

A possibly pertinent provision of the regulations is that they are not to be interpreted to prevent the discharge or emission of an aqueous steam in the open air unless such discharge constitutes a safety hazard.

## California

Air pollution is controlled in California under Chapter 957, Statutes of 1975, Recodification of California Air Pollution Control Laws. The State Air Resources Board in the Resources Agency is the control agency for mobile sources, although regulatory and enforcement powers over stationary sources are vested in air pollution control districts. The APCD's may embrace only one county or may be regional in scope. The regulations of the APCD's embracing Northern Sonoma County where The Geysers are located, neighboring Lake County, Mendocino County, and Imperial County were reviewed as representative of the known geothermal areas.

The Northern Sonoma County APCD has adopted a new set of regulations establishing specific $H_2S$ emissions standards applicable to both geothermal power plant emissions and those of the pre-power emissions -- well drilling, testing and clean-out, well bleeds, and other attendant functions. The standards for power plants set two maximum six-month average $H_2S$ emissions limitations to be effective September 30, 1976, and June 30, 1978, respectively -- 631 and 386 kg (1,390 and 850 lb) $H_2S$/hr -- and two maximum 24-hour averages -- 704 and 443 kg (1,550 and 975 lb)/hr -- to be achieved by the same dates. New limitations for 1979 and 1980 application will be promulgated later after review of available technology, air quality, emissions, and meteorological data.

The total pre-power plant emissions of $H_2S$ associated with all existing geothermal power plants are limited to an annual average of 81.7 kg (180 lb)/hr as of December 31, 1976, and to 68.1 kg (150 lb)/hr on December 31, 1978. New standards will be set for 1980 achievement. The total pre-power plant emissions of $H_2S$ associated with new power plants are not to exceed 7.5 percent of the annual $H_2S$ produced with the steam supply or 70 percent for greater than 24 hours. This 24-hour standard is also applied to pre-power emissions during shutdown of existing power plants whose $H_2S$ emissions have been abated.

In addition, the North Sonoma County APCD regulations limit ground-level concentrations of total reduced sulfur (TRS) compounds to 0.03 ppm for 60 minutes expressed as $H_2S$. TRS emissions are limited to 60 ppm by volume or to total daily weight calculated by the formula, whichever is more restrictive:

$$\text{TRS (lb/day)} - 0.12\,(H_s)^2$$

$H_s$ = height in feet of the emission point above mean ground elevation

Minimum ground elevation is computed as the arithmetic average of the highest and lowest ground-level elevations within a 1,000 yard radius of the emission point.

In Mendocino County the allowable fallout particulate matter is limited to 5.25 kkg/$km^2$ (15 tons/$mi^2$) in a residential or commercial area, based on a one-month averaging period, and 10.50 kkg/$km^2$ (30 tons/$mi^2$) in industrial areas. Sonoma County exempts from permit requirements water cooling towers and water cooling ponds not used for evaporative cooling of water from barometric jets or from barometric condensers.

The California state ambient air quality standards are shown in Table V-6. They are applicable statewide, with the exception of those for the Lake Tahoe Air Basin, and their achievement must be supported by adequate basinwide air pollution control standards as well as those of the APCD's. There are no other statewide air pollution control regulations in California.

## Colorado

The Colorado Air Pollution Control Act of 1970 gives the Air Pollution Control Commission, Department of Health, the power to adopt implementing regulations. Pertinent features of these which are not summarized above follow:

### Ambient Air Standards for Metropolitan Denver Air Quality Control Region, Air Quality Control Areas, and the State of Colorado--

Colorado effectively has two particulate ambient air standards at present -- one level for its metropolitan areas and one for less developed areas. The

## TABLE V-6. AMBIENT AIR QUALITY STANDARDS

| Pollutant | Averaging Time | California Standards$^1$ | | National Standards$^2$ | | |
|---|---|---|---|---|---|---|
| | | Concentration$^3$ | Method$^4$ | Primary$^{3,5}$ | Secondary$^{3,6}$ | Method$^7$ |
| Oxidant (Ozone) | 1 hour | 0.10 ppm (200 ug/m$^3$) | Ultraviolet Photometry | 160 ug/m$^3$ (0.08 ppm) | Same as Primary Std. | Chemiluminescent Method |
| Carbon Monoxide | 12 hour | 10 ppm (11 mg/m$^3$) | Non-Dispersive Infrared Spectroscopy | - | Same as Primary Standards | Non-Dispersive Infrared Spectroscopy |
| | 8 hour | - | | 10 mg/m$^3$ (0 ppm) | | |
| | 1 hour | 40 ppm (46 mg/m$^3$) | | 40 mg/m$^3$ (35 ppm) | | |
| Nitrogen Dioxide | Annual Average | - | Saltzman Method | 100 ug/m$^3$ (0.05 ppm) | Same as Primary Standards | Proposed: Modified J-H Saltzman ($O_3$ corr.) Chemiluminescent |
| | 1 hour | 0.25 ppm (470 ug/m$^3$) | | - | | |
| Sulfur Dioxide | Annual Average | - | Conductimetric Method | 80 ug/m$^3$ (0.03 ppm) | - | Pararosaniline Method |
| | 24 hour | 0.04 ppm (105 ug/m$^3$) | | 365 ug/m$^3$ (0.14 ppm) | - | |
| | 3 hour | - | | - | 1300 ug/m$^3$ (0.5 ppm) | |
| | 1 hour | 0.5 ppm (1310 ug/m$^3$) | | - | - | |
| Suspended Particulate Matter | Annual Geometric Mean | 60 ug/m$^3$ | High Volume Sampling | 75 ug/m$^3$ | 60 ug/m$^3$ | High Volume Sampling |
| | 24 hour | 100 ug/m$^3$ | | 260 ug/m$^3$ | 150 ug/m$^3$ | |
| Lead | 30 Day Average | 1.5 ug/m$^3$ | High Volume Sampling Dithizone Method | - | - | - |
| Hydrogen Sulfide | 1 hour | 0.03 ppm (42 ug/m$^3$) | Cadmium Hydroxide Stractan Method | - | - | - |
| Hydrocarbons (Corrected for Methane) | 3 hour (6-9 a.m.) | - | - | 160 ug/m$^3$ (0.24 ppm) | Same as Primary Standards | Flame lonization Detection Using Gas Chromatography |
| Ethylane | 8 hour | 0.1 ppm | - | - | - | - |
| | 1 hour | 0.5 ppm | | | | |
| Visibility | 1 observation | In sufficient amount to (8) reduce the prevailing visibility to less than 10 miles when the relative humidity is less than 70% | | - | - | - |

NOTES:

1. California standards are values that are not to be equaled or exceeded.

2. National standards, other than those based on annual averages or annual geometric means, are not to be exceeded more than once per year.

3. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 mm of mercury. All measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 mm of Hg (1,013.2 millibar); ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

4. Any equivalent procedure which can be shown to the satisfaction of the Air Resources Board to give equivalent results at or near the level of the air quality standard may be used.

5. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health. Each state must attain the primary standards no later than three years after that state's implementation plan is approved by the Environmental Protection Agency (EPA).

6. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Each state must attain the secondary standards within a "reasonable time" after implementation plan is approved by the EPA.

7. Reference method as described by the EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the EPA.

8. Prevailing visibility is defined as the greatest visibility which is attained or surpassed around at least half or the horizon circle, but not necessarily in continuous sectors.

second is much more restrictive. However, through graduated reductions in the urban standards all areas in the state will become subject to the same standard in 1980.

These separate areas are also treated differently in the sulfur dioxide ambient air standards. The urban areas are subject to the standards discussed above which are somewhat more restrictive than the federal limits. However, sulfur dioxide levels in non-urban areas are subjected to allowable increments in sulfur dioxide over baseline $SO_2$ concentrations. The permitted increments are very small: 3 $\mu g/m^3$ (.001 ppm)[2] to the annual mean level of 50 $\mu g/m^3$ (0.02 ppm); 15 $\mu g/m^3$ (0.006 ppm) to the 24-hour maximum of 260 $\mu g/m^3$ (0.10 ppm); and 75 $\mu g/m^3$ (0.03 ppm) to the three-hour maximum of 1,300 $\mu g/m^3$ (0.50 ppm). This was accomplished by adopting area classifications similar to those of the federal significant deterioration regulations. This was singularly a state action, however, and no request for reclassification was made to EPA.

Depending on how they are implemented, Colorado's odor regulations applicable to manufacturing processes outside the residential or commercial areas could be beneficial to geothermal development. While these require use of the best practicable treatment and control available for odor reduction, "best practicable" is not to be interpreted as "any method which would result in an arbitrary and unreasonable taking of property or in the practical closing of any lawful business or activity, if such would be without corresponding public benefit." However, this provision notwithstanding, odors strong enough to be detectable after dilution with 127 or more volumes of odor-free air are a violation.

Regulation to Control Emissions of Chemical Substances and Physical Agents--
This regulation is applicable statewide and deals with substances considered to be highly toxic. For the most part, the regulation is source-specific and would not presently cover geothermal operations. However, it could serve as a model for future regulation should toxic emissions develop from geothermal operations.

### Idaho

The Idaho Air Pollution Control Act as amended (Idaho Code Title 39, Chapter 29) confers upon the Board of Environmental Pollution and Health the authority to adopt rules and regulations for the control of air pollution in Idaho. The regulation as adopted in 1972 was subsequently amended to serve as the state's plan to implement the ambient air quality standards of the federal Clean Air Act. The Department of Health and Welfare is the implementing agency.

Rules and Regulations for the Control of Air Pollution in Idaho--
These rules set forth three ambient air quality standards of potential interest to the geothermal industry in addition to the six required. These include:

Sulfuric Acid Mist:
Primary and secondary standards:
Maximum 24-hour concentration - 12 $\mu g/m^3$ not to be exceeded more than once/month
Maximum 1-hour concentration - 30 $\mu g/m^3$ not to be exceeded more than twice/week

Fluorides:

Primary and secondary air quality standards are those concentrations in the ambient air which result in a total fluoride content in vegetation used for feed and forage of not more than:

40 ppm dry basis - annual arithmetic mean
60 ppm dry basis - monthly concentration for two consecutive months
80 ppm dry basis - monthly concentration never to be exceeded

These standards will probably have no effect on geothermal operations.

Settleable Particulate:

Primary and secondary standards are:
0.8 $mg/cm^2/mo$ not to be exceeded more than 25 percent of the time

## Louisiana

Section 2204 of Title 40 of the Revised Statutes of Louisiana established the Air Control Commission which promulgated the regulations below. The Commission in conjunction with the Health and Human Resources Division administers the regulations.

Regulations, Air Control Commission--

These regulations contain an ambient air standard on sulfuric acid mist, sulfur trioxide, or any combination thereof as follows:

4 $\mu g/m^3$ maximum annual average
12 $\mu g/m^3$ 24-hour average not to be exceeded over 1% of the time
30 $\mu g/m^3$ 1-hour average not to be exceeded over 1% of the time

## Montana

The Air Quality Bureau, Environmental Services Division, Montana Department of Health and Environmental Sciences, administers the state air pollution control program and operates under the following regulations.

State of Montana Air Quality Rules--

The significant feature of the Montana regulations insofar as the geothermal industry is concerned is the very stringent odor control described above. The application of the only other similar standard found was limited to animal rendering plants. The oddity is, however, that as strict as the Montana regulations are in one sense, they do not define odor except as "that property of an emission which stimulates the sense of smell."

## Nevada

The portions of Nevada's Air Quality Regulations dealing with stationary sources are administered by the Department of Human Resources.

Air Quality Regulations--

While it may not be unique, Nevada has incorporated a somewhat unusual provision on "Confidential Information." It prohibits the certification as confidential emissions of an air contaminant which is the subject of an ambient air quality standard or emission standard or has been designated as a hazardous air pollutant by EPA. In the case of geothermal production and use this would not appear to pose a hardship. While identification of pollutants would tend to disclose something about the character of the resource in a given area, this does not appear to share the competitive consequences of disclosing the nature of material input to a product. This section also provides that information certified as confidential can be used in the prosecution of violations of any air pollution statute, ordinance, or regulation.

The Nevada regulations require the air pollution control agency to investigate an odor when 30 percent or more of a sample of the people exposed to it believe it to be objectionable in usual places of occupancy. (The sample is to include at least 20 people or 75 percent of those exposed, if fewer than 20 are involved.) Odors detectable after dilution with eight or more volumes of odor-free air occurring twice within an hour -- at least 15 minutes apart -- constitute a violation.

Nevada provided for review of new complex sources and large stationary sources of air pollution. Geothermal operations would not be classified under complex sources but probably would be considered a single source under the terms of this regulation. Upon application for a registration certificate the applicant must provide an environmental assessment and any other information the director of the control agency may request. The most significant aspect of the assessment appears to be the monitoring provisions which are somewhat confusing. In one paragraph, the director is authorized to require as a condition of the certificate that an operator conduct ambient air quality monitoring at the facility site for a reasonable period prior to commencement of construction and for any specified period after the source has commenced operation. Another paragraph provides that the environmental evaluation consider "existing ambient air concentrations...measured with approved methods at approved site locations for not less than one year." (Emphasis added.)

Nevada also requires that sources of sulfur emissions utilize Supplementary Control Systems to provide rapid curtailment of the rate of sulfur emissions during adverse meteorological conditions. These systems are to include continuous sampling of wind characteristics and atmospheric stability, continuous ambient air quality monitoring at one or more sites and continuous recording, and an operating predictive model for forecasting ambient air quality, or as an alternative at the discretion of the director, approved threshold values on which to base control decisions. These requirements appear to apply only to sulfur dioxide emissions and, therefore, may not affect many, if any, geothermal operations.

## New Mexico

Air pollution is controlled in New Mexico under the Air Quality Control Act, Chapter 277, Laws of 1967 as amended, which is administered by the Environmental Improvement Board.

### Air Quality Control Regulation Number 100--

These regulations contain ambient air quality standards for $H_2S$. The limitation is 0.003 ppm for some areas of the state and 0.030 ppm in others. These areas are identified in Table V-4.

## Oregon

The Department of Environmental Quality administers the air pollution regulations adopted by the Environmental Quality Commission.

### Oregon Administrative Rules, Chapter 340--

These regulations purport to impose state environmental standards upon federal lands which are classified as wilderness areas under the Wilderness Act, P.L. 88-577. Whether geothermal activity would be permitted in these areas under the Act is open to some question, but since mining is allowed, this is a possibility. It would, however, face very difficult obstacles -- one of them being a five percent opacity limit on air emissions, or no greater than 10 percent with a special permit. The latter is half the obstruction permitted under No. 1 on the Ringelmann scale.

Oregon applies to a four-county area (Clackamas, Columbia, Multonomah, and Washington) a provision which requires capture of air contaminants which would otherwise be emitted through doors or windows and transfer to air pollution control equipment. The most efficient and best practicable loading, shrouding, or dusting equipment available is required. New sources are to comply at the time of installation.

In these four counties, odors may not exceed a scentometer No. 0 odor strength or equivalent dilution in residential and commercial areas and a No. 2 strength in other areas. Opacity is also limited to 20 percent in these counties.

## Texas

The Texas Air Control Board operates under the Texas Clean Air Act, codified as Article 447-5. The Board has issued General Rules and a series of separate regulations for the control of air pollution.

### Control of Air Pollution from Visible Emissions and Particulate Matter--

These regulations contain a set of particulate emission standards which do not appear in the requirements of the other states surveyed. These prohibit emissions which exceed any of the following ground level concentrations:

100 $\mu g/m^3$ of air sampled, averaged over any five consecutive hours

200 $\mu g/m^3$ of air sampled, averaged over any three consecutive hours

400 $\mu g/m^3$ of air sampled, averaged over any one-hour period

Maximum ground level concentrations of $SO_2$ are also set which vary over the state. They are 747 $\mu g/m^3$ (0.28 ppm) averaged over a 30-minute period in Galveston and Harris Counties, 853 $\mu g/m^3$ (0.32 ppm) in Jefferson and Orange Counties, and 1067 $\mu g/m^3$ (0.4 ppm) in the rest of the state with some exceptions in El Paso County. The Texas $H_2S$ standards are shown in Table V-4.

Sulfuric acid emissions may not exceed:

1. A net ground-level concentration of 15 $\mu g/m^3$ of air averaged over any 24-hour period; or

2. A net ground-level concentration of 50 $\mu g/m^3$ of air averaged over a one-hour period of time more than once during any consecutive 24-hour period; or

3. 100 $\mu g/m^3$ of air maximum at any time.

## Utah

Air conservation regulations were adopted by the Utah Air Conservation Committee and the State Board of Health pursuant to the Air Conservation Act. The Division of Health, Department of Social Sciences, is the implementing agency.

### Air Conservation Regulations--

The bulk of these regulations conforms very closely with those of other states with one notable exception. This is the exemption from notice of construction of exhaust systems for controlling steam and heat which do not contain combustion products.

## Washington

The Department of Ecology of the State of Washington implements the state's air pollution control program pursuant to Chapter 43.21A RCW and the state Clean Air Act in Chapter 70.94 RCW.

### General Regulations for Air Pollution Sources Chapter 18.04 Washington Administrative Code--

The Washington regulations offer another good example of a general, nonspecific type of odor regulation. It reads as follows:

> "Any person who shall cause or allow the generation of any odor from any source which may unreasonably interfere with an adjoining property owner's use and enjoyment of his property must use recognized good practice and procedure to reduce these odors to a reasonable minimum."

The emission of water vapor is prohibited if it causes detriment to public health, safety, or welfare, or damage to property or business. The construction of a new stationary source may be prohibited which would cause significant deterioration of the air quality of areas where the quality already exceeds the $SO_2$ and particulate ambient air quality standard. "Significant deterioration" is not defined.

## Wyoming

The Wyoming regulations were promulgated pursuant to Chapter 9.1, Articles 1-11, Wyoming Statutes, 1973 Cumulative Supplement and are administered by the Division of Air Quality, Department of Environmental Quality.

### Air Quality Standards and Regulations--

These regulations apply sulfate, hydrogen sulfide, and fluoride ambient air quality standards in addition to those required by the Clean Air Act. The suspended sulfate limitation is 0.25 $mg/SO_3/100\ cm^2$, maximum annual average, measured as a sulfation rate by the lead peroxide method. The $H_2S$ standards are shown in Table V-4.

The regulations also require that any exit process gas stream containing hydrogen sulfide which is discharged to the atmosphere from any source be vented, incinerated, flared, or otherwise disposed of in such a manner that ambient sulfur dioxide and hydrogen sulfide standards are not exceeded.

In defining the process weight per hour used to calculate allowable emissions under a particulate standard predicated on process weight, the Wyoming regulations expressly exclude "any water, water vapor, or steam that may be introduced as part of the total materials."

Effective odor control devices are required which will limit odors at the property line to those of sufficient strength to be equal to but no greater than that detectable after seven dilutions with odor free air as determined by a scentometer or of lower strength. Two measurements within one hour separated by at least 15 minutes are required.

## WATER QUALITY

The Federal Water Pollution Control Act requires EPA to develop water quality criteria which accurately reflect the latest scientific knowledge on the kind and extent of all identifiable effects on health and welfare which may be expected from the presence of pollutants in any body of water or groundwater. The criteria specify concentrations of water constituents which, if not exceeded, will achieve the water quality which is desirable or necessary for specific uses. The water quality criteria are not enforceable standards in themselves but form the basis upon which state water quality standards are set.

The standards consist of criteria -- i.e., limits on the concentrations of various parameters allowed in receiving streams or restrictions on changes in pH, temperature, or other characteristics of surface waters -- and plans for the enforcement or implementation of the criteria. The criteria may be more stringent than the values in the federal criteria if a state so desires. In the absence of industrywide limitations on the actual amount of each pollutant which may be lawfully discharged by geothermal operations, the water quality standards will be used as the basis for calculating pounds-per-unit-of-production effluent limitations imposed in the NPDES permit, the primary mechanism for controlling water pollution, as discussed earlier. Thus, the standards may assume an importance for this industry which may not attach as directly to those industries for whom EPA has established effluent limitations guidelines.

Many, if not most, state waters are classified according to use. The classifications may include entire water bodies or may vary from reach to reach of the same stream. Separate water quality criteria are applied to the specific classifications which will either maintain the quality to support the use or uses or permit the attainment of that quality. These criteria vary in stringency according to degree of purity required for the designated uses.

The result of the separate stream classifications and differences among states even in the general criteria applied to unclassified waters is that the permit effluent limitations calculated may vary, depending on where the discharge is to take place. The limitations could differ for operations even a few miles apart on the same stream.

The designated uses usually follow the federal criteria rather closely and include some combination of the following:

Public water supplies
Recreation and aesthetics
Fish, other aquatic life, and wildlife
Agricultural use
Industrial use

Some states employ even further breakdowns. A common one is differentiation among waters suitable for potable purposes with: (1) only simple disinfection; (2) after removal of naturally occurring parameters; and (3) after treatment equal to coagulation, sedimentation, filtration, and disinfection. The criteria graduate to less stringency with less demanding designated uses.

Federal numerical criteria are shown in Table V-7, for domestic water supplies. These are excerpted from the latest revision of Quality Criteria for Water [16]. It will be noted that there are no criteria presented for several parameters of potential interest to the geothermal community for water supply use. However, some of them are covered in the criteria for other uses such as protection of wildlife. These include beryllium, boron, total dissolved gases, hardness, nickel, and hydrogen sulfide. The criterion for the latter for fish and other aquatic life, fresh and marine water, is 2 μg/l of undissociated $H_2S$. No state water quality standards applicable to this parameter were found.

Radioactivity, which appeared as a parameter in earlier federal criteria, was dropped in this most recent revision. In addition, there are no criteria for aluminum, fluoride, lithium, molybdenum, or vanadium, all of which have been found in geothermal deposits in this country. EPA recommends, however, that these parameters be considered in state water quality standards.

It will also be noted that the values for some of the parameters are expressed in μg/l, or parts per billion, rather than mg/l, or parts per million, which has been used exclusively in the past. The combined usage avoids extremely large numbers on the one hand, or unmanageable decimals on the other.

In many cases, criteria are descriptive rather than numerical. These general provisions applicable to all waters are found in all state water quality standards. They prohibit:

Toxic chemicals in concentrations found to be of public health significance or to adversely affect the use for which waters are classified.

Substances which taint edible fish or impart tastes or odors to drinking water supplies.

Floating or submerged matter.

TABLE V-7. FEDERAL WATER QUALITY CRITERIA FOR DOMESTIC WATER SUPPLIES [17]*

| | |
|---|---|
| Arsenic | 50 μg/l |
| Barium | 1 mg/l |
| Cadmium | 10 μg/l |
| Chromium | 50 μg/l |
| Copper | 1 mg/l |
| Iron | 0.3 mg/l |
| Lead | 50 μg/l |
| Manganese | 50 μg/l |
| Mercury | 2 μg/l |
| Nitrate Nitrogen (N) | 10 mg/l |
| Oil and Grease | Virtually free from |
| pH | Range 5-9 |
| Phenol | 1 μg/l |
| Selenium | 10 μg/l |
| Silver | 50 μg/l |
| Solids (Dissolved) and Salinity | 250 mg/l (for chlorides and sulfates) |
| Zinc | 5000 μg/l |

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* Pesticides are not included.

Excess nutrients which cause slime growths or other nuisance aquatic growths.

Visible concentrations of oil, sludge deposits, scum, or foam.

Objectionable turbidity.

There are several other provisions which are common to nearly all state water pollution regulations. These include a paragraph which states that notwithstanding the water quality standards contained therein, where a higher standard can be achieved, it is to be attained by the best practicable treatment and/or control of wastewaters. Another paragraph, which originated as model legislation at the federal level, is the antidegradation requirement that waters whose quality exceeds the standards will be maintained at their existing high quality.

This concept is, of course, consistent which the stated objective of P.L 92-500 -- i.e., "to restore and maintain (emphasis added) the chemical, physical, and biological integrity of the Nation's waters." Sometimes this provision is qualified by the statement that such change may be permitted if demonstrated to the state agency and EPA to be justifiable as a result of necessary economic or social development.

The ensuing summaries of state water quality standards are thus limited to a large extent to numerical criteria. This is the area of most variety among them. Selected parameters addressed by the various state regulations are identified in Table V-8.

The regulations for 15 states are listed in Table V-9 along with the statutes they implement. The agencies which administer them are identified in Table V-2.

Fecal coliform criteria are omitted from the summaries since this form of pollution is not anticipated from the processes of geothermal development. However, since some state regulations require sanitary facilities on site, operators in those areas would be required to treat the sewage to meet the fecal coliform standards.

In order to place the state water quality standards in perspective, they are preceded by summaries of two other documents. The first is the California state statute authorizing the regulation of water quality in the state. This statute, the Porter-Cologne Water Quality Control Act, was selected to illustrate this type of state law because it was the most comprehensive one reviewed. The others incorporate some of its provisions in one form or another, and the general intent is, of course, common to them all.

The second document introduced is the California "Waste Discharge Reports and Requirements." This is the state's implementaton of the NPDES permit program which will through necessity indirectly utilize water quality standards to provide effluent limitations.

TABLE V-8. NUMERICAL WATER QUALITY STANDARDS
(X= applies statewide; *= applies only to designated waters)

| | ALASKA | ARIZONA | CALIFORNIA | COLORADO | HAWAII | IDAHO | LOUISIANA | MONTANA | NEVADA | NEW MEXICO | OREGON | TEXAS | UTAH | WASHINGTON | WYOMING |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alkalinity | | | | | | | | | | | | | | | |
| Ammonia | | | | | | | | | | | | | | | |
| Arsenic | | * | x | | | | | * | | | * | x | 3 | | |
| Barium | | * | x | | | | | | | | * | x | 3 | | |
| Boron | | * | | | | | | | * | | * | | | | |
| Cadmium | | * | x | | | | | * | | | * | x | 3 | | |
| Chloride | | | | | | | * | | x | * | * | * | 3 | | |
| Chromium(hex.) | | * | x | | | | | | | | * | x | 3 | | |
| Conductivity | | | | | | | | | | * | * | | | | |
| Copper | | * | | | | | | * | | | * | x | 3 | | |
| DO | x | * | | x | x | x | x | * | x | x | x | x | x | x | x |
| Fluoride | | | | | | | | | | | * | | 3 | | |
| Hardness | | | | | | | | | | | | | | | |
| Iron | | | | | | | | * | | | * | | 3 | | |
| Lead | | * | x | | | | | * | | | * | x | 3 | | |
| Manganese | | | | | | | | | | | * | | 3 | | |
| Mercury | | * | x | | | | | * | | | | x | | | |
| Nickel | | | | | | | | | | | | x | | | |
| Nitrates (+nitrites) | | | x | | | | | | x | | | | 3 | | |
| pH (range) | x | * | | x | x | x | x | x | x | x | x | x | x | x | |
| Phosphorus | | | | | | | | | * | * | | | | | |
| Radioactivity[1] | * | x | | x | | x | x | * | x | | x | x | x | x | x |
| Selenium | | * | x | | | | | | | | | x | 3 | | |
| Silver | | * | | | | | | | | | | x | 3 | | |
| Sulfate | | | | | | | * | | | * | | * | 3 | | |
| Total Dissolved Gas | | | | | | x | | x | | x | x | | | x | * |
| Total Dissolved Solids | * | | | | * | | * | | * | * | * | * | 3 | | |
| Toxic Materials | * | x[2] | | x[2] | | | x | x | *[2] | x | | x | | x | x[2] |
| Uranyl ion | | | | | | | | | | | | | | | |
| Zinc | | * | | | | | | * | | | * | x | 3 | | |

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[1] Of other than natural origin. [2] Free from. [3] The Utah standards for most waters of the state require chemical characteristics in conformance with the Public Health Services Drinking Water Standards, 1962.

## TABLE V-9. STATE STATUTES AND REGULATIONS
## Water Pollution Control

| State | Statute | Regulation |
|---|---|---|
| Alaska | Title 46, Alaska Statutes, Water, Air, and Environmental Conservation | Title 18, Environmental Conservation, Chapter 70, Water Quality Standards, and Chapter 72, Wastewater Disposal |
| Arizona | Arizona Revised Statutes 36-1851 | Water Quality Standards for Surface Waters |
| California | Porter-Cologne Water Quality Control Act (Division 1, Chapter 2, Water Code) and Related Code Sections | Titles 17 and 23, California Administrative Code |
| Colorado | Colorado Water Quality Control Act, Title 25, Article 8 CRS 1973 | Water Quality Standards and Stream Classification |
| | Sections 66-1-7(6) and (19),Colorado Revised Statutes 1963, as amended | Regulations for the State Discharge Permit<br>Standards for the Quality of Water Supplied to the Public |
| Hawaii | Environmental Quality Laws and Regulations, Vol. 1, Part III, Water Pollution, as amended | Water Pollution Control Regulations, Public Health Regulations Chapter 37 and 37A |
| Idaho | Title 39, Chapter 1, and Title 67, Chapter 52, Idaho Code; Chapter 87 Idaho Session Laws 1973 | Water Quality Standards and Wastewater Treatment Requirements |
| Louisiana | Act Establishing the Stream Control Commission, Title 56, Chapter 3, Stream Control | Regulation Requiring Submission for Reports for the Discharge of Industrial Waste and for the Construc- |

Continued

TABLE V-9 (continued)

| | | |
|---|---|---|
| Montana Cont'd. | | tion or Alteration of Treatment Works<br>Rules Governing Disposal of Waste Oil, Oil Field Brine, and All Other Materials Resulting from the Drilling for, Production of, or Transportation of Oil, Gas or Sulfur<br>Water Quality Criteria |
| Montana | Environmental Policy Act, RCM, Title 69 Montana Water Quality Criteria | Pollutant Discharge Elimination System, Reg. 16-2. 14(10)-SI4460 |
| Nevada | Water Pollution Control Law, NRS 445.131 to 445.354, inclusive | Water Pollution Control Regulations |
| New Mexico | Water Quality Control Act, Chapter 326, Laws of 1973, as amended | Water Quality Standards for Interstate and Intrastate Streams in New Mexico |
| Oregon | Oregon Environmental Laws, Revised Statutes Chapter 468-700-775 | Regulations Relating to Water Quality Control in Oregon, Chapter 340, Oregon Administrative Rules |
| Texas | Chapter 21, Texas Water Code - Water Quality Act | Water Quality Standards |
| Utah | Water Pollution Control Act, Title 73, Chapter 14, Utah Code Annotated 1953, as amended | Water Quality Standards, Code of Waste Disposal Regulations, Dept of Health, Part II |
| Washington | Water Pollution Control, Chapter 90.48, RCW | Water Quality Standards, Chapter 173-201, WAC |
| Wyoming | 1973 Cumulative Supplement, 35-502.19, 1973 Session Laws, 35-487.19 | Water Quality Rules and Regulations |

### Porter-Cologne Water Quality Control Act, Division 7, Water Quality

This act establishes the authority of the state to regulate all activities and factors which may affect the quality of the state's waters. It places the responsibility for administering the statewide water quality control program in the hands of nine regional water quality control boards. The State Water Resources Control Board, however, holds the primary adjudicatory and regulatory functions of the state in the field of water resources under Division 1 of the State Water Code. It formulates state policy for water quality control and establishes procedures under which the regional boards develop and implement water quality control plans, and is the state's water pollution control agency as defined by the Federal Water Pollution Control Act, and, as such, implements the NPDES permit system within the state. This function is also carried out by the regional boards. The state board and each regional board are the principal state agencies with primary responsibility for the coordination and control of water quality.

Neither the Act nor rulings of the state or regional boards precludes cities and counties from adopting and enforcing more stringent regulations or to prohibit nuisances.

The regional water quality control plans designate: (1) beneficial uses to be protected; (2) water quality objectives; and (3) programs of implementation needed for achieving water quality objectives. It is recognized in the Act that it may be possible to change the quality of water to some degree without unreasonably affecting beneficial uses. On the other hand, a water quality control plan or waste discharge requirements may specify certain conditions or areas where the discharge of waste, or certain types of wastes, will not be permitted. The water quality control plans are binding on the activities of all state agencies.

Waste Discharge Requirements--

Any person discharging or proposing to discharge wastes which could affect water quality must file a report with the regional board containing such information as required by the board. Subsequently, and after any necessary hearing, the board prescribes requirements as to the nature of the discharge or material change therein which are related to conditions in the disposal area or receiving waters. The "requirements," a term which is equivalent to the word "permits" in the Federal Water Pollution Control Act, must implement relevant water quality control plans and consider the beneficial uses to be protected, water quality objectives required for that purpose, other waste discharges, and the need to prevent nuisance. A set of waste discharge requirements issued by the North Coast Regional Water Quality Control Board for the wastes of a geothermal drilling and exploration operation are shown in Appendix B.

The prescribed requirements need not authorize utilization of the full waste assimilation capacities of receiving waters and may contain a time schedule for compliance. The Act also establishes the policy that all discharges of wastes into streams are privileges, not rights -- i.e., regardless of whether a discharge is made pursuant to waste discharge requirements (permit) it does not create a vested right to continue the discharge.

A discharger may be required to furnish water quality monitoring and other technical information and the contents of the reports may be used in judicial review or enforcement proceedings. Notification to a geothermal operator setting forth a monitoring and reporting program to be followed is shown in Appendix C. It covers both waste materials destined for land disposal and liquids to be disposed of by injection. Trade secrets or secret processes are not to be made available to the public, however. The regional board has right-of-entry authority to inspect a discharger's facilities to determine compliance.

Chapter 5.5 of the Act ties the state discharge requirements to the provisions of the Federal Water Pollution Control Act. In effect, the discharge requirements (permits) must ensure compliance with any applicable effluent limitations, more stringent effluent limitations to meet water quality standards, national standards of performance, and toxic and pretreatment effluent standards. As discussed elsewhere in this report, no effluent guidelines related to geothermal production have been promulgated and none are recommended at this time.

Discharge requirements (permits) are adopted for a fixed term not to exceed five years, and must be reviewed for possible revision every five years. Under this chapter the above monitoring report requirements are extended to mandate installation and use of monitoring equipment and sampling procedures.

A civil penalty not to exceed $10,000 is imposed for each day of discharge not in compliance with the waste discharge requirement or which violates a cease and desist order or any of the federal requirements listed above. In addition, the discharges may be subject to a preliminary or permanent injunction.

Where such non-complying discharges are deemed a willful or negligent act, the fine increases to not more than $25,000 nor less than $2,500 for each day's violation and imprisonment for not more than one year, or both. For repeated offenses, the fine is not more than $50,000 per day or imprisonment for not more than two years or both.

The above enforcement measures are all geared to federal requirements and prevail over other sections of the Act to the extent of any inconsistency. However, the regional boards and state courts do have other enforcement tools available. These include:

1. Filing of a detailed time schedule by a discharger to show the specific actions to be taken to correct or prevent a violation of discharge requirements.

2. Cease and desist orders and orders to (a) comply forthwith, (b) comply in accordance with a set time schedule, or (c) take appropriate remedial or preventative action.

3. Prohibitory or mandatory injunctions, either preliminary or permanent.

Enforcement actions of the regional boards are subject to state board review.

A discharger is allowed to comply with his discharge requirements (permit), state or regional board order, or court decree in any lawful manner. The state cannot mandate the specifics of his compliance steps with one important exception. This is the disposition of solid waste which requires special handling to prevent leakage to underground or surface waters.

In a section of the Act dealing with water reclamation it is stated:

> "No person shall construct, maintain or use any waste well extending to or into a subterranean water-bearing stratum that is used or intended to be used as, or is suitable for, a source of water supply for domestic purposes. Notwithstanding the foregoing, when a regional board finds that water quality considerations do not preclude controlled recharge of such stratum by direct injection, and when the State Department of Health, following a public hearing, finds the proposed recharge will not impair the quality of water in the receiving aquifer as a source of water supply for domestic purposes, reclaimed water may be injected by a well into such stratum."

"Waste well" is defined as any hole dug or drilled into the ground, used or intended to be used for the disposal of waste. The state Department of Health is given authority to regulate this activity.

Geothermal wells are specifically exempt from another section of the Act governing water wells.

Title 23, Waters, State of California Administrative Code--
The subchapter of these regulations which spells out the NPDES discharge permit procedures in elaborate detail is shown in full in Appendix K. The section which deals with the application of effluent standards and limitations and water quality standards (2235.5(b)) specifically addresses the situation in which no federal effluent limitations and standards have been promulgated for an industrial source. It provides a very broad discretionary area by stating that "waste discharge requirements (permits) shall contain effluent limits and other conditions necessary to carry out the provisions of the Federal Water Pollution Control Act."

Time schedules are to be attached to the permit in which any discharges which are not in full compliance with the permit conditions must be brought into compliance.

Alaska

Title 18, Chapter 70, Water Quality Standards--Alaska Administrative Code--
These standards were adopted by the Department of Environmental Conservation pursuant to Title 46, Alaska Statutes, Water, Air, and Environmental Conservation. They are also implemented by the Department.

Seven water use classifications are established as follows:

1. Class A. Water supply, drinking, culinary, and food processing without the need for treatment other than simple disinfection and simple removal of naturally present impurities.

2. Class B. Water supply, drinking, culinary, and food processing with the need for treatment equal to coagulation, sedimentation, filtration, disinfection, and any other treatment process necessary to remove naturally present impurities.

3. Class C. Water contact recreation.

4. Class D. Growth and propagation of fish and other aquatic life, including waterfowl and furbearers.

5. Class E. Shellfish growth and propagation, including natural and commercial growing area.

6. Class F. Agricultural water supply, including irrigation, stock watering, and truck farming.

7. Class G. Industrial water supply (other than food processing).

Water quality criteria are set for various parameters which are in general the same parameters covered by the federal water quality criteria [16]. Prescribed limitations are also generally in accord with the federal criteria, although some upper limits are lower than the federal criteria. If waters have more than one classification, the most stringent criterion applies.

Treatment equivalent to BPCTCA is required for all industrial waste discharges by existing sources as soon as possible but no later than July 1977. New sources are to conform at the time of construction.

Title 18, Chapter 72, Alaska Administrative Code, Wastewater Disposal--

Perhaps the most significant aspect of Alaska's wastewater disposal regulations related to geothermal development is that the subsurface discharge of industrial liquid waste is prohibited, except that material from or for production of petroleum products may be reinjected or injected into the ground. It is assumed, in light of Sec. 38.05.181 (p)(2) of Title 38 which permits reinjection of geothermal steam or its residue, that this exception in the regulations has been or will be construed to include geothermal production.

Under Chapter 72, the Department may require more stringent treatment than the minimum prescribed in Chapter 70 or prohibit the discharge of treated wastewater to sensitive environments. A waste disposal permit is required for sludge disposal and the Department may require that industrial treatment systems be designed or operated to accept and treat sludges. A provision of specific interest in geothermal development is one which requires that designs for treatment works in remote areas be proven in comparable environmental situations. Such systems must also be designed to operate successfully under seasonal or perennial frost conditions.

### Arizona

Water Quality Standards for Surface Waters--

These standards were adopted by and are administered by the Department of Health Services pursuant to 36-1851 Arizona Revised Statutes. The numerical values on all parameters are very much in line with the federal criteria except that the value for mercury -- 0.005 mg/l compares with a federal criterion of 0.002 mg/l or 2 μg/l. In addition, the same limits are applied to the list of substances regardless of water use. This has the effect of making the standards somewhat stricter than the federal criteria because in the latter these specific limitations are imposed only on public water supplies. The substances covered and the limiting concentrations are as follows:

| Substance | Limiting Concentration (mg/l) |
|---|---|
| Arsenic | 0.05 |
| Barium | 1.0 |
| Cadmium | 0.01 |
| Chromium (hexavalent) | 0.05 |
| Copper | 1.0 |
| Lead | 0.05 |
| Mercury | 0.005 |
| Phenol | 0.001 |
| Selenium | 0.01 |
| Silver | 0.05 |
| Zinc | 5.0 |

Turbidity in waters for recreational and aesthetic use and for fish, aquatic life, and wildlife are to be maintained at the lowest practicable values possible but in no case shall:

a. Turbidity in the surface waters due to the discharge of wastes exceed 50 Jackson units in warm water fishery streams or 10 Jackson units in cold water fishery streams.

b. Discharge to warm water fishery lakes cause turbidities to exceed 25 Jackson units, and discharge to cold water fishery lakes cause turbidities to exceed 10 Jackson units.

These standards are applicable to turbidity caused by activities including, but not limited to, construction, mining, logging, and related land uses.

Thermal discharges become a factor in the fish, aquatic life, and wildlife category. The standards are as follows:

a. Warm fisheries - Heat added to any warm water fishery shall be the lowest practical value. In no case shall heat be added in excess of that amount that would raise the temperature of the minimum daily flow of record for that month more than 2.8°C (5°F) above the monthly average of the maximum daily water temperature prevailing in the water or stream section under consideration; nor shall heat be added in excess of that amount that would raise the stream temperature above 34°C (93°F). This provision shall not apply to lakes or impoundments owned by a firm or individual for the express purpose of providing and/or receiving heat wastes.

b. Cold water fisheries - Heat added to cold water fisheries shall be the lowest practical value. In no case shall heated wastes be discharged in the vicinity of spawning areas. In other areas, winter temperatures (November through March) shall not be raised above 13°C (55°F) and summer temperatures (April through October) shall not be raised above 21°C (70°F). In both winter and summer, heat shall not be added in excess of that amount that would raise the temperature of the minimum daily flow of record for that month more than 1.1°C (2°F) above the monthly average of the maximum daily water temperatures prevailing in the water or stream section under consideration. These provisions shall not apply to lakes or impoundments owned by a firm or individual for the express purpose of providing cooling water and/or receiving heat wastes.

The state's waters are all classified according to primary and incidental use. A primary use is the recognized use of the water for purposes of designating the applicable specific use standards; the exercise of a primary use which interferes with the attainment of the standards associated with the incidental use is not a violation.

Rules and Regulations for Sewerage Systems
and Treatment Works, Article 2, Part 3--

Under these regulations, the discharge of treated effluents into wells to a depth which penetrates water-bearing strata is prohibited. In addition, the discharge of these effluents into any crevice, sinkhole, or other opening, either natural or artificial, or in a rock formation which will or may permit the contamination of groundwater is similarly prohibited.

## California

Title 17, Public Health, California Administrative
Code and Regional Water Quality Control Plan Reports--

The Regional Water Quality Control Boards in California adopt Water Quality Control Plans and the reports on these plans contain water quality standards which are applicable regionwide and others which apply only to specified waters. However, the basin limiting concentrations applied for chemical constituents in public water supplies are those set forth in Title 17, Chapter 5, of the Administrative Code. This is the codification of the public health laws.

The Regional Boards are empowered to set more stringent standards and they do so for some bodies of water. For example, the Central Valley Regional Board set separate inorganic chemical limits for portions of the Sacramento River, the American River, and Folson Lake which permit in some cases only a tenth of the concentration permitted by Title 17. The Boards also may set standards for parameters which do not appear in Title 17. The Central Valley Regional Board, for example, added copper, iron, manganese, silver, and zinc to the special standards for the above rivers and lake.

The state limitations are as follows:

| Substance | Limiting Concentration (mg/l) |
|---|---|
| Arsenic | 0.10 |
| Barium | 1.0 |
| Cadmium | 0.01 |
| Chromium | 0.05 |
| Cyanide | 0.2 |
| Lead | 0.05 |
| Mercury | 0.005 |

| Substance | Limiting Concentration (mg/l) |
|---|---|
| Nitrate-N + Nitrite-N | 10 |
| Selenium | 0.01 |

It may be noted that the arsenic and mercury standards are twice as permissive as the federal criteria.

The standards set by the Colorado River Basin Region for all surface receiving waters in the West Colorado River Basin are shown in Table V-10 for illustration. The maximum arsenic concentration of 0.06 mg/l compares with a level of 0.01 mg/l in the special standards set by the Central Valley Regional Board for the waters listed above. The barium concentrations are 0.55 mg/l and 0.1 mg/l respectively, and copper, 0.06 and 0.01.

TABLE V-10. LIMITING CONCENTRATIONS OF CHEMICALS IN DISCHARGES OF WASTES TO SURFACE WATERS IN THE WEST COLORADO RIVER BASIN IN CALIFORNIA

| Constituent | Limiting Concentration (mg/l)* | |
|---|---|---|
| | 90th Percentile | Maximum |
| Aluminum (Al) | 0.10 | 0.11 |
| Arsenic (As) | 0.05 | 0.06 |
| Barium (Ba) | 0.50 | 0.55 |
| Cadmium (Cd) | 0.01 | 0.01 |
| Chromium (Total Cr) | 0.05 | 0.06 |
| Copper (Cu) | 0.05 | 0.06 |
| Cyanide (CN) | 0.005 | 0.01 |
| Iron (Fe) | 0.20 | 0.22 |
| Lead (Pb) | 0.05 | 0.06 |
| Manganese (Mn) | 0.05 | 0.06 |
| Selenium (Se) | 0.01 | 0.01 |
| Silver (Ag) | 0.01 | 0.01 |
| Zinc (Zn) | 0.05 | 0.06 |
| Mercury (Hg) | 0.005 | 0.01 |

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*Where natural levels already meet or exceed these levels no further increases from controlled sources are allowed.

Some of the regional standards limit the concentration of boron in waters used for agricultural purposes to 0.50 mg/l.

Since the numerical limitations vary from region to region and from one reach of a river or portion of a lake to another within the regions and the standards are subject to continuing modification, no attempt has been made here to document all of them for the state. A range of values will be selected for evaluation in terms of control technology requirements in Phase II of this project

## Colorado

Water Quality Standards and Stream Classification--

The Colorado Water Quality Control Commission in the Department of Health both adopted and administers these regulations. They were promulgated pursuant to the Colorado Water Quality Control Act. The water quality standards summarized in Table V-11 are excerpted from the regulations. The table is shown in full even though some of the parameters are not addressed in other state summaries since it is a concise presentation of a typical list of parameters covered.

Waters classified as $A_1$ or $A_2$ are waters suitable for or to become suitable for all purposes for which raw water is customarily used, including primary contact recreation, such as swimming and water skiing. The differences between $A_1$ and $A_2$ requirements, as shown in the table, are in the dissolved oxygen levels and temperatures, with the $A_1$ waters being capable of supporting a cold water fishery, and the $A_2$ waters being suitable for warm water fishes only.

Class $B_1$ and $B_2$ waters are waters suitable for or to become suitable for all purposes for which raw water is customarily used, except primary contact recreation. The variations between the two are again in DO and temperature.

## Hawaii

Chapter 37, Public Health Regulations, Water Pollution Control, and Chapter 37-A, Water Quality Standards--

These regulations were adopted pursuant to Chapter 342, Hawaii Revised Statutes, and are administered by the Department of Health. The important provision in Title 37 is that prior to promulgation of applicable effluent limitations and standards NPDES permits will be subject to such conditions as the Department determines are necessary to carry out the provisions of the Federal Water Pollution Control Act.

Water quality standards for toxic or corrosive substances require as a minimum evaluation by use of a 96-hour bioassay as described in the most recent edition of Standard Methods for the Examination of Water and Wastewater. Survival of test organisms shall not be less than that in controls which utilize appropriate experimental water.

Coastal and fresh waters are classified for each major island according to use and there are some very limiting standards for the highest class of coastal waters. Only a half unit of pH difference is permitted in these waters from other than natural causes; total dissolved solids are not to be below 28,000 mg/l from other than natural causes; and water temperature is not to change more than 1.5°.

Concentrations of radioactive materials are not to exceed the Public Health Drinking Water Standards [18][19] and must be less than those that would require restrictions on the use of organisms harvested from the area in order to meet the Radiation Protection Guides recommended by the Federal Radiation Council.

## Idaho

## TABLE V-11. COLORADO WATER QUALITY STANDARDS SUMMARY

| STANDARD | CLASS | | | |
|---|---|---|---|---|
| | $A_1$ | $A_2$ | $B_1$ | $B_2$ |
| Settleable Solids | Free From | Free From | Free From | Free From |
| Floating Solids | Free From | Free From | Free From | Free From |
| Taste, Odor, Color | Free From | Free From | Free From | Free From |
| Toxic Materials | Free From | Free From | Free From | Free From |
| Oil and Grease | Cause a film or other discoloration | Cause a film or other discoloration | Cause a film or other discoloration | Cause a film or other discoloration |
| Radioactive Material | Drinking Water Standards | Drinking Water Standards | Drinking Water Standards | Drinking Water Standards |
| Fecal Coliform Bacteria | Geometric Mean of 200/100ml from five samples in 30-day per. | Geometric Mean of 200/100ml from five samples in 30-day per. | Geometric Mean of 1000/100ml from five samples in 30-day per. | Geometric Mean of 1000/100ml from five samples in 30-day per. |
| Turbidity | No increase of more than 10 J.T.U. | No increase of more than 10 J.T.U. | No increase of more than 10 J.T.U. | No increase of more than 10 J.T.U. |
| Dissolved Oxygen | 6 mg/l minimum | 5 mg/l minimum | 6 mg/l minimum | 5 mg/l minimum |
| pH | 6.5 - 8.5 | 6.5 - 8.5 | 6.0 - 9.0 | 6.0 - 9.0 |
| Temperature | Maximum 68°F.<br>Maximum Change 2°F. | Maximum 90°F.<br>Maximum Change:<br>Streams - 5°F.<br>Lakes - 3°F. | Maximum 68°F.<br>Maximum Change 2°F. | Maximum 90°F.<br>Maximum Change:<br>Streams - 5°F.<br>Lakes - 3°F. |
| Fecal Streptococcus | Monthly average of 20/100ml from five samples in 30-day per. | Monthly average of 20/100ml from five samples in 30-day per. | ---- | ---- |

Water Quality Standards and Wastewater Treatment Requirements--
These standards and regulations were adopted pursuant to Title 39 Chapter 1 and Title 67 Chapter 52 Idaho Code and Chapter 87 Idaho Sessions Laws 1973. Regulatory authority is given to the Idaho Department of Environmental and Community Services.

The dissolved oxygen water quality standard prohibits a DO concentration of less than 6.0 mg/l or 90 percent of saturation whichever is greater. This is applied to all flowing waterways and to lakes and reservoirs except for specified bottom depths of the latter where the limit is 4.0 mg/l. For comparison, the new federal criteria [17] do not place limits on DO in the public water supply use category, but call for a minimum of 5.0 mg/l to maintain good fish populations.

The limits on temperature increases are quite strict. No measurable increase is permitted when water temperatures are 19°C (66°F) or above, and increases are limited to 1.1°C (2°F) when water temperatures are 18°C (64°F) or less. For some specified waterways, the upper and lower limits are 20°C (68°F) and 19°C (66°F), respectively. "Measurable increase" means no more than 0.28°C (0.5°F) rise in temperature of the receiving water as measured immediately outside the mixing zone. This standard indicates that all waters of the state are to be kept suitable for cold water fishes.

The turbidity standard is also strict. No industrial activity may cause turbidity to exceed 5 JTU or where this level is already exceeded, may cause alone or in combination with other effluents, an increase of more than 5 JTU.

Idaho also imposes a standard on radioactivity other than that of natural origin. This type of regulation will require interpretation in any case where radon or any other radioactive material is associated with geothermal products. It could be considered of natural origin, but would constitute a pollutant nevertheless.

In the regulations governing wastewater discharges, adequate treatment is determined to be the equivalent of 85 percent BOD and suspended solids removal or conformance with any more stringent limitations necessary to meet the state's water quality standards. Presumably, in the absence of federal effluent limitations and new source performance standards for geothermal production and use, this provision would prevail in NPDES permit conditions.

Wastewater discharge to disposal wells must be treated up to the quality of the existing underground waters or in conformance with the Idaho Drinking Water Standards. The Drinking Water Standards provide that more suitable supplies should be sought when certain substances are present in a water supply in excess of specified concentrations, and when others are present in excess of the stated concentrations, the water supply should be rejected. Very few of the substances, if any, would be expected to be a product of geothermal development. It might be noted, however, that the grounds for rejection are almost identical to the permissible federal criteria for public water supplies on lead, selenium, arsenic, and other inorganic chemicals.

## Louisiana

Water Quality Criteria--

The Louisiana Stream Commission adopted these water quality criteria pursuant to Title 56:1439 of the Louisiana Revised Statutes. They are designated primarily to preserve existing water quality as it relates to suitability for various uses. In several instances, where existing technology permits, provisions have been made for upgrading water quality.

For all uses, toxic substances may not exceed the $TLM_{96}/10$. Where the stream is to be used as a public water supply the level of toxic substances may not exceed the levels of the latest edition of the U.S. Public Health Service drinking water standards [17][18].

The general pH criterion is a range of 6.0 to 9.0 although this varies for classified waters. No discharge of wastes is to cause the pH of the water body to vary by more than one pH unit within the pH range specific to a classified water. Criteria for chlorides, sulfates, and dissolved solids levels also vary from one classified water to another, but the values in general represent the arithmetic mean of existing data plus one standard deviation.

The temperature standard consists of two parts -- a temperature differential which represents the maximum permissible rise above ambient conditions and a maximum temperature. No addition of artificial heat is permitted once the ambient temperature reaches the latter. The standards are as follows:

Fresh Water - Temperature differential

(1) Maximum of 2.8°C (5°F) rise above ambient for streams and rivers.

(2) Maximum of 1.7°C (3°F) rise above ambient for lakes and reservoirs.

MAXIMUM TEMPERATURE - 32.2°C (90°F) except where otherwise listed in the tables or due to natural conditions.

Estuarine and Coastal Waters - Temperature differential

(1) Maximum of 2.2°C (4°F) rise above ambient during the period October through May.

(2) Maximum 0.83°C (1.5°F) during the period June through September.

MAXIMUM TEMPERATURE - 35°C (95°F) except when natural conditions elevate temperature above this level.

The individual stream standards contain limits on chlorides, sulfate, DO, and total dissolved solids. The latter range from 75 to 3000 mg/l.

Title 30, Chapter I, Louisiana Revised Statutes--

This state law authorizes the Commissioner of Conservation to regulate the underground disposal of salt water and industrial waste. The Department of Conservation thus requires that salt water be injected into a sand which carries salt water and that the injected water will not displace any fresh water up gradient or be put in a sand which produces oil or gas. Permits are required for salt water injection wells.

While these requirements are contained in Statewide Order 29-B which governs oil and gas wells, they appear to be broad enough to cover the injection of salt water regardless of its source. If geothermal deposits contain a high percentage of methane which may be the case in Louisiana, these rules could apply in any event.

## Montana

Water Quality Standards (MAC 16-2.14(10)-S14480)--
The Board of Health and Environmental Sciences adopted these regulations pursuant to the Environmental Policy Act and they are administered by the Department of Environmental Sciences. The water quality criteria for the highest classification of waters are the ultimate in limitations since they prohibit any change in pH or any increase in turbidity, temperature, sediment, toxic substances, or radioactivity and do not apply a dissolved oxygen criterion. These waters are described as suitable for drinking, culinary, and food processing after simple disinfection and are closed to public access and activities such as livestock grazing and timber harvest.

In the second classification -- for the same uses as above plus nearly all other uses including swimming with removal of naturally present impurities added to disinfection -- the criteria are somewhat less stringent. Dissolved oxygen concentration is not to be reduced below 7.0 mg/l; induced variation in pH within the range of 6.5 to 8.5 is to be less than 0.5 pH unit; and natural pH outside this range is to be maintained without change and pH above 7.0 is to be maintained above 7.0. No increase in natural turbidity is allowed and permissible temperature increases are 0.5°F to 1.0°F, depending on initial water temperature. No sediment increase which adversely affects the use is permitted. Concentrations of toxic substances which after treatment for domestic use will exceed the federal drinking water regulations are prohibited [18][19]. In any case, maximum allowable concentrations are to be less than acute or chronic problem levels as revealed by bioassay or other methods.

The criteria for less demanding uses follow the usual pattern of gradually decreasing stringency. The standards also introduce a limitation on color which for some waters is two units above natural color and for other is five units.

The general criterion of most concern to geothermal operations is one which requires that industrial waste in the absence of federal effluent limitations guidelines receive a minimum of secondary treatment or equivalent. This standard, contrary to a similar one in another state, at least leaves an alternative for treatment of wastes if they are not amenable to biological methods, the usual definition of secondary treatment.

The Montana regulations also contain very detailed criteria on radiation which apply to all waters except the closed classification described above. They are as follows:

"The average dissolved concentrations (including the naturally occurring or background contribution) of iodine 131, radium-226, strontium-89, strontium-90 and tritium are not to exceed the following concentration limits:

| | |
|---|---|
| Iodine-131 | 5 pCi/L |
| Radium-226 | 1 pCi/L |
| Strontium-89 | 100 pCi/L |
| Strontium-90 | 10 pCi/L |
| Tritium | 3,000 pCi/L |

"For all other radionuclides, the average dissolved concentration limits are to be 1/150 of the corresponding maximum permissible concentration in water for continuous occupational exposure as recommended by the National Committee on Radiation Protection (National Bureau of Standards Handbook 69 or subsequent revisions.)

"For a mixture of radionuclides, the following relationship is to be satisfied:

$$\frac{C_1}{L_1} + \frac{C_2}{L_2} \cdot \cdot \cdot \cdot \cdot \cdot \cdot + \frac{C_n}{L_n} \qquad 1.00$$

C denotes the average concentration of the respective radionuclide, and L denotes its concentration limit.

"Where alpha emitters, strontium-90, radium-228, iodine-129, iodine-130 and lead-210 are known to be absent, routine analysis for dissolved gross beta radioactivity (excluding potassium-40 contribution) may be employed to monitor and show compliance with this criterion (except for tritium) as long as the gross concentration does not exceed 100 pCi/L. When these conditions are not met, routine quantitative analyses of individual radionuclides are to be performed to show compliance. Except in cases where tritium from other than natural sources is known to be absent, routine tritium analyses are to be performed to show compliance. (Note: "Absence" means a negligibly small fraction of the specific concentration limit, where the limit for unidentified alpha emitters is taken as the limit for radium-226).

"For radionuclides associated with suspended material in transport, the average concentration limits are to be a 1/150 of the corresponding maximum permissible concentration in water (insoluble form) for continuous occupational exposure as recommended by the National Committee on Radiation Protection. In-stream sedimentation of these materials is not to produce solids beds that are not in compliance with subsections (q) (i) and (q) (ii) (because of leaching) and/or excessive accumulation in native flora and fauna.

"Average concentrations are to be computed from monitoring data acquired during the previous 12 months; maximum concentrations are not to exceed three times the average concentration limits specified."

The regulations go on to state that variances from concentration limits specified will be permitted if the contributing source is non-controllable or a natural source. Either criterion could conceivably be applied to geothermal waters or steam although how this will be interpreted is not clear at this time. It is possible, too, that the standards may have little or no effect on geothermal operations because there is no associated problem of radioactivity.

## Nevada

### Water Pollution Control Regulations--

These regulations were adopted by the State Environmental Commission pursuant to the Water Pollution Control Law and are administered by the Department of Human Resources. They prohibit the discharge of industrial wastes containing arsenic, barium, boron, cadmium, chromium, cyanide, fluoride, lead, selenium, silver, copper, and zinc which are "reasonably amenable" to treatment or control without treatment. In addition, the concentrations of these constituents for most water uses must be consistent with the limits of the 1962 Drinking Water Standards [18]. However, in the highest classification of waters, Class A, all industrial and toxic wastes are prohibited altogether. Temperature increases above natural receiving water temperature are prohibited in Class A and B. The allowable increase is 3°C (5.4°F) in Class C, and there is no limit for Class D. Total dissolved solids are not to exceed 500 mg/l in all classifications or one-third above that characteristic of normal conditions, whichever is lesser.

The pH range for Classes A, B, and C is 6.5 to 8.5 and 6.0 to 9 for Class D which includes waters in a highly altered watershed which receive a multiplicity of discharges. The minimum dissolved oxygen levels are 6.0 mg/l for Class A, 6.0 for trout waters and 5.0 mg/l for non-trout waters in Classes B and C, and 3.0 mg/l in Class D.

Standards are also set which apply to specific reaches which set more stringent limitations on the above parameters and also include limits on chlorides, phosphorus, or boron.

## New Mexico

### Water Quality Standards for Interstate and Intrastate Streams--

These standards were adopted by the Water Quality Control Commission pursuant to the New Mexico Water Quality Act (Chapter 326, Laws of 1973, as amended).

In addition to prohibiting toxic substances in detrimental concentrations, these regulations require determination of toxicities of substances in receiving water by bioassays or other acceptable means for the particular form of aquatic life to be preserved. Concentrations of toxic materials are not to exceed five percent of the 96-hour median tolerance limit except that substances which bioconcentrate are not to be present in concentrations which result in their magnification. Public water supplies are to be protected from hazardous substances which exceed the federal drinking water regulations.

The radioactivity of surface waters is to be maintained at the lowest practical level and in no case is to exceed the standards adopted pursuant to the New Mexico Radiation Protection Act. As of now, no numerical standards have been promulgated.

Surface waters must be free of nitrogen and other dissolved gases at levels above 110 percent saturation when this level is due to industrial discharges.

Separate sets of standards are set forth for all waterways or reaches of waterways in the state and vary, of course, according to designated uses. The stream use designation and standards are shown for the Rio Grande Basin in Appendix L. These illustrate very clearly the range in the degree of restriction. For example, in the Elephant Battle Reservoir, at mean monthly flows above 100 cfs, the standards for the following parameters are:

TDS shall be less than 1500 mg/l
Sulfate shall be less than 500 mg/l
Chloride shall be less than 250 mg/l

The standards for the same parameters in one reach of the main stem of the Rio Grande are 500, 150, and 25 mg/l respectively. Required dissolved oxygen levels are generally greater than 5 mg/l, but 4 mg/l is acceptable in some cases. Turbidity is to be less than 50 FTU. (This unit of measurement -- Formazin Turbidity Unit -- is not comparable to the Jackson Turbidity Unit (JTU) but the values are not greatly different.) Conductivity in at least one instance is limited to less than 300 umho.

This example was not selected because there is or may be geothermal activity in the Rio Grande Basin. It is merely a good illustration of the way New Mexico has handled its water quality standards and the typical numerical ranges.

Some standards do not include a turbidity value. In these instances turbidity is not to reduce light transmission to the point where existing desirable aquatic life is inhibited or to cause substantial visible contrast with the natural appearance of the water.

## Oregon

Regulations Relating to Water Quality Control in Oregon (Oregon Administrative Rules, Chapter 340) --

The Environmental Quality Commission of Oregon adopts the water quality regulations which are implemented by the Department of Environmental Quality. The Oregon Environmental Laws, Revised Statutes, Chapter 468-700-775, are the statutory authority.

General water quality standards are set for all waters of the state except where they are superseded by more stringent special standards. The most significant features of the general standards are the dissolved oxygen requirements of 6.0 mg/l or more and the permissible temperature increases. No measurable increase is permitted when receiving water temperatures are 18°C (64°F) or greater; no more than 0.28°C (0.5°F) increase due to a single-source discharge when water temperatures are 17.5°C (63.5°F) or less; and no more than 1.1°C (2.0°F) from all combined sources when water temperatures are

16.7°C (62°F) or less. The concentration of total dissolved gas is not to exceed 105 percent of saturation except when stream flow exceeds the 10-year, 7-day average flood.

Some of the special standards for reaches of various receiving streams increase the DO standard to more than 7 mg/l and limit turbidity increases to 5 JTU above background. The same rates of temperature increase are also applied in the special standards but to different water temperatures, most frequently colder streams. pH ranges from 7.0 - 9 and 7.0 - 8.5 compared to 6.5 - 8.5 in the general standards. In some instances conductivity is limited to 400 micromhos at 77°.

## Texas

Water Quality Standards --

These standards were adopted by the Texas Water Quality Board pursuant to Sections 21.075 - 21.078 of the Texas Water Code. They tabulate numerical standards for all of the state's waters. The only aspect of either the pH or DO standards which is particularly noteworthy is that 4.0 mg/l is acceptable DO for a large number of areas, 5.0 is the common criteria, and in at least one area 3.0 is the value. These are more permissive numbers than those which generally prevail on the west coast. In addition, diurnal variations of 1.0 mg/l below the standard specified in the tables are permitted for not more than eight hours in any 24-hour period. The chloride standards range all the way from 40 mg/l to 30,000 mg/l. A great many are in the 100 - 200 mg/l level, but those in the thousands are not uncommon. The sulfate standards range from 30 mg/l to 4500 mg/l; many range between 60 - 500 mg/l.

There are no standards set on salinity in estuarine waters. However, note is made that the state proposes to adopt salinity criteria for these areas, using both existing data and data yet to be collected, upon which future regulatory actions may be based. This could be an important action to coastal geothermal operations.

The maximum temperature difference permitted in fresh water streams is 2.8°C (5.0°F) rise over ambient and 1.7°C (3.0°F) for fresh water impoundments. In tidal river reaches, bay, and gulf waters the maximum permitted temperature difference is 2.2°C (4.0°F) in fall, winter, and spring, and 0.83°C (1.5°F) in summer.

## Utah

Water Quality Standards (Code of Waste Disposal Regulations, Utah State Department of Health, Part II) --

These regulations, adopted pursuant to the state's Water Pollution Control Act, are administered by the Water Pollution Control Board. Standards are set for six major classifications of waters and some subcategories. In addition, wastes discharged to waters of a given classification must be capable of meeting all downstream classifications.

The scope of the standards states that the standards of quality are applied to waste discharges or to waters of the state as appropriate under the applicable statutes "except that no waste of any kind shall be discharged from controlled areas until subjected to at least secondary treatment." A state spokesman interpreted "controlled areas" as fenced or limited access areas such as a wastewater treatment plant or lagoon. Secondary treatment was defined as a maximum discharge concentration of 25 mg/l of both BOD and settleable solids. This would be an unnecessary standard to apply to geothermal-type wastes; some equivalency language appears needed.

A major difference in the higher classifications is the degree to which treatment of the waters will be necessitated for use as water supplies, and the standards are largely descriptive rather than numerical. The physical, chemical, bacteriological and radiological standards are based for the highest uses on the Public Health Service Drinking Water Standards of 1962 [18]. Radioactive substances are limited to 1/30th of the $MPC_w$ values given for continuous occupational exposure in the National Bureau of Standards Handbook 61 or to those which will not result in accumulation of radioactivity in edible plants and animals that present a hazard to consumers.

## Washington

Water Quality Standards, Washington Administrative Code, Chapter 173-201 --
These standards were adopted by the Department of Ecology pursuant to Chapter 90.48 RCW, Water Pollution Control. Five classes of waters are established for the purpose of applying water quality criteria. They are: Class AA, Extraordinary; Class A, Excellent; Class B, Good; Class C, Fair; and the Lake Class. Characteristic uses to be practiced in each classification are itemized and the waters of the state are classified.

The general characteristic called for in Class AA is that water quality shall markedly and uniformly exceed the requirements for all or substantially all uses. The wording ranges downward in stringency to water quality that meets or exceeds the requirement of selected and essential uses in Class C.

Dissolved oxygen standards range from in excess of 9.5 mg/l for fresh water and 7.0 mg/l for marine water in Class AA to 5.0 and 4.0 respectively in Class C. Induced temperature increases (°F) from one source are based on equations and in the case of Class AA waters may not exceed $t=75/(T-22)$ (fresh water) or $t=24/(T-39)$ (marine water); "t" represents the permissible increase and "T" represents the water temperature due to all causes combined. pH variations are limited to less than 0.1 units in Class AA, 0.25 units in Class A, 0.5 in Class B, and 0.5 units in Class C.

In lakes, no change is permitted to be made in dissolved oxygen levels, temperature, or pH. Turbidity in excess of 5 JTU over natural conditions is prohibited in Class AA, A, and lakes, and 10 JTU is the limit in Class B and C. In all classes, the concentration of total dissolved gas is not to exceed 110 percent of saturation at any point of sample collection.

## Wyoming

Wyoming Water Quality Rules and Regulations --
These regulations are administered by the Department of Environmental

Quality. In classifying the state's waters, priority will be given to those waters which receive pollutants. A water must be classified before a permit to discharge to that water is issued.

Water quality standards have been established for 15 parameters. Supplementary standards will not be written for constituents that are not expected to be present, or in such low concentrations as to present no problem in the foreseeable future. However, it is the basic concept that additional standards can be adopted at any time conditions warrant it. Specific numerical limits are not set for toxic materials since all possible compounds, combinations, and effects are not known.

Dissolved oxygen standards range from a minimum content of 6 mg/l in Class I waters to no induced reduction in fish spawning areas. Allowable temperature alterations range from 1.1°C (2°F) in streams where natural temperatures do not exceed 20°C (68°F) to 2.2°C (4°F) in warm water fishery areas of streams with natural temperature exceeding 20°C (68°F).

Wastes are not permitted which will cause the pH to be less than 6.5 or greater than 8.5. The standards note that high salinity (total dissolved solids) may cause adverse impact on waters and that water quality standards for salinity would be adopted not later than October 18, 1975. However, nothing was found in the Wyoming documents submitted which indicates this has been done.

## SOLID WASTE REGULATIONS

Again, in summarizing solid waste regulations, general provisions dealing with permits,.licenses, etc. have been omitted, as have the mechanics of sanitary landfilling. While the language of some of the regulations appears to be directed toward land disposal sites operated for public use, nothing was found which seems to preclude private landfills provided the proper approval or permit is achieved. The statutes and regulations of the 15 "geothermal" states are identified in Table V-12. The administering agencies are shown in Table V-2.

### Alaska

Chapter 60, 18 AAC, Solid Waste Management --
These regulations, promulgated and administered by the Department of Environmental Conservation, simply require solid waste to be collected, stored, transported, and disposed of so as to control, prevent, or abate pollution of the air, water, land, and subsurface land. Regional authorities are permitted to adopt more stringent requirements.

### Arizona

Rules and Regulations for Refuse and Other Objectionable Wastes, Article 2, Part 4 --
These regulations were adopted and are administered by the Department of Health Services. They specify that the collection and disposal of all refuse

## TABLE V-12. STATE STATUTES AND REGULATIONS
### Solid Waste Disposal

| State | Statute | Regulation |
|---|---|---|
| Alaska | Alaska Dept. of Environmental Conservation Act, Laws of Alaska, Title 44, Chapter 46 | Title 18, Alaska Administrative Code, Environmental Conservation, Chapter 60, Solid Waste Management |
| Arizona | A.R.S. 36-105, B., 10 | Arizona Solid Waste Rules and Regulations for Refuse and Other Objectionable Wastes, ARS, Title 36, Chapter 1 |
| California | Solid Waste Management and Resource Recovery Act of 1972, Calif. Government Codes, Title 7.3 and Health and Safety Code, Part 2, Div. 5 | Statewide Policy for Solid Waste Management Including Minimum Standards for Solid Waste Handling and Disposal<br>Sections 66783.1 and 66784, Government Code |
| | Hazardous Waste Control Act, Calif. Health & Safety Codes, Div. 20 | (Also see water pollution control regulations.) |
| Colorado | Title 30, Article 20, Part 1, Solid Wastes Disposal Sites and Facilities Law | Solid Wastes Disposal Sites and Facilities |
| Hawaii | Environmental Quality Law Chapter 342, Hawaii Revised Statutes | Solid Waste Management Control Regulations |
| Idaho | Idaho Solid Waste Law, Title 31, Chapter 44, Idaho Code; Chapter 104, Laws of 1970, as amended | Solid Waste Management Regulations and Standards |
| Louisiana | Solid Waste Laws, Revised Statutes of 1950, Titles 33 & 40 | Louisiana Solid Waste Regulations, Chapter 4, Sanitary Codes |

Continued

Table V-12 (Continued)

| | | |
|---|---|---|
| Montana | Refuse Disposal Control Law, Title 69, Chapter 40 RCM 1969 | Refuse Disposal Regulations, Title 16, MAC, as amended |
| Nevada | Nevada Solid Waste Disposal Law, Nevada Revised Statutes 444.440-444-630 | Regulations Governing Solid Waste Management |
| New Mexico | Environmental Improvement Act, Chapter 277, Laws of 1971, as amended | Solid Waste Management Regulations |
| Oregon | Oregon Environmental Laws, Chapter 459, as amended | Chapter 340, Oregon Administrative Rules Compilation, Solid Waste Management in General and Procedures of Issuance, Denial, Modification, and Revocation of Licenses for the Disposal of Environmentally Hazardous Wastes |
| Texas | Solid Waste Disposal Act, Act of 1969, Chapter 405, Article 4477-7, Vernon's Annotated Civil Statutes, as amended | Regulations on Disposal of Industrial Solid Waste |
| Utah | 26-15-5, U.C.A., 1953, as amended | Code of Solid Waste Regulations |
| Washington | Chapter 70.95, RCW, Solid Waste Management Law | Chapter 173-301, WAC, Regulation Relating to Minimum Functional Standards for Solid Waste Handling |
| | (and numerous other specialized laws and rules) | |
| Wyoming | Environmental Quality Act of 1973, Article 5, Solid Waste Management | Solid Waste Management Rules and Regulations |

not acceptable for collection by a collection agency are the responsibility of the facility where the refuse accumulates. However, no criteria for unacceptable wastes are given nor are "collection agencies" defined. It is assumed from other sections that anything which does not qualify as garbage refuse, rubbish, ashes, or manure probably is not acceptable. All dangerous materials and substances are to be rendered harmless, where necessary, prior to collection and disposal. No explanation is given as to what constitutes a "necessary" situation.

The methods of disposal recommended include sanitary landfill, incineration, and composting. Nothing more environmentally acceptable for toxic wastes is suggested. Approval for the disposal method must be obtained from the state or a local Department of Health.

California

Minimum Standards for Solid Waste Handling and Disposal (Register 75, No. 18, Title 14, Division 7) --

These standards were adopted by the Solid Waste Management Board which administers them jointly with the Department of Health. They are designed to describe levels of performance expected rather than setting forth detailed requirements; operators and designers are generally permitted flexibility of approach in meeting the objectives set by the standards. Solid wastes are defined to include solid and semisolid industrial wastes and liquid wastes disposed of in conjunction with solid wastes. The disposal site standards, however, apply only to those which receive Group 2 wastes as defined by the state water pollution control regulations -- i.e., wastes which consist of or contain chemically or biologically decomposable material, but which do not include toxic substances nor those capable of significantly impairing the quality of usable waters.

The latter wastes are defined in Subchapter 15 of the California water regulations as Group 1 wastes and disposal is required in Class I disposal sites. These sites are discussed in Section III. Group 1 wastes specifically include brines from geothermal plants and rotary drilling muds containing toxic materials. Thus, the water regulations are much more important to the geothermal industry in terms of land disposal of wastes than the above entitled standards for solid waste handling at Class I sites.

There is, however, a provision in the California Solid Waste Management and Resource Recovery Act of 1972 which, depending upon its interpretation, appears to offer an alternative. It states that "no provision of the Act or any ruling pursuant thereto will limit the right of any person to dispose of organic and toxic waste materials on his own property in evaporization (sic) ponds from which there is no drainage or seepage." No other criteria are applied. Since the bulk of geothermal activity is on leased land its application would, in any event, be limited.

Hazardous wastes cannot be deposited at Class II sites unless the site has been approved for the particular wastes. Liquid wastes and sludges may be accepted only as approved by the California Regional Water Quality Control Board.

The general design and public health design parameters require that consideration be given to all data regarding the site (nature and quantity of wastes, climatological factors, physical setting, present and planned use of adjacent land, etc.) and to other factors such as air and water quality and noise and odor control.

These regulations were effective July 1, 1976. A state spokesman pointed out that new drilling mud disposal sites will be subject to Section 66783.1 of Chapter 541 of the state code which requires approval of new disposal sites by the state Solid Waste Management Board in counties until a solid waste management plan is adopted.

## Colorado

Title 30, Article 20 - Part 1, Solid Waste Disposal Sites and Facilities -- This statute governs solid waste disposal sites in unincorporated counties and authorizes incorporated areas to designate such sites. However, it exempts private dumping on one's own property as long as it does not constitute a public nuisance and is in accordance with the rules and regulations of the Department of Health. These regulations follow.

Solid Wastes Disposal Sites and Facilities -- These regulations apply to all solid waste disposal sites within the state whether they are located in incorporated or unincorporated areas. "Solid waste" includes waste materials from industrial activities. Minimum standards, design criteria, operating practices, and closing requirements are established which pertain to such standard items as odor control, minimization of nuisance conditions, etc. Radioactive materials are barred from disposal in sites not specifically designated for that purpose, but there is no reference to other specific wastes, such as drilling mud, which might be potentially troublesome to geothermal operations. No provision is made for secured landfill.

## Hawaii

Chapter 46, Public Health Regulations, Solid Waste Management Control -- These regulations, promulgated and administered by the Department of Health, require a permit for the disposal of solid wastes except for soil, rock, concrete, or other nondecomposable materials disposed of in landfill sites used by the owner or person in control of the premises.

Each county is directed to see that facilities for the disposal of hazardous waste materials are available. If toxic, caustic, or otherwise hazardous wastes are delivered directly to a landfill, they must be rendered nonhazardous by chemical neutralization or stabilization prior to final disposal.

Specially constructed trenches or pits are required for the disposal of chemical wastes in landfill. These must be designed to retain the wastes and prevent infiltration into ground and surface waters.

## Idaho

Solid Waste Management Regulations and Standards --
These regulations were adopted by the Board of Health and Welfare and are implemented by the Department of Health and Welfare. They require that all solid wastes shall be managed from storage to disposal in a manner which will prevent health hazards, public nuisances, or pollution of the environment. Specifically, handling methods are not to:

1. Provide sustenance to rodents or insects which are capable of causing human disease or discomfort;
2. Cause or contribute to the pollution of air;
3. Cause or contribute to the pollution of surface or underground waters;
4. Cause excessive abuse of land;
5. Cause or contribute to noise pollution;
6. Abuse the natural aesthetic quality of an area; or
7. Physically impair the environment to the detriment of man and beneficial plant life, fish, and wildlife.

Conditional use permits for disposal areas which are less than sanitary landfills may be acquired under some conditions. These circumstances include:

1. Extremely low population density in an isolated area;
2. Geology or topography of the area is such to prohibit a sanitary landfill;
3. No collection or transfer system is available or practical;
4. Local climatic conditions are too adverse;
5. There is no involvement of federal lands or federal facilities;
6. Wastes are of a type not suitable for disposal in a sanitary landfill; or
7. Other unusual circumstances.

The standards for sanitary landfill include a requirement for a sufficient number of borings or wells to determine the soil characteristics, geology, and groundwater conditions and for background water quality standards. A well to monitor groundwater quality may be required at those sites where conditions of rainfall, geology of the site, soil characteristics, groundwater management, and drainage are marginal. Where surface waters may cause a leachate problem or if a leachate problem develops, a collection and treatment system will be required.

Disposal of liquids and hazardous wastes in a sanitary landfill is not permitted until the methods of disposal, suitability of the site, and plan of operation have been approved and a conditional use permit issued. When possible, all toxic and hazardous wastes are to be neutralized or otherwise made harmless prior to disposal.

## Louisiana

Louisiana Solid Waste Laws (Louisiana Revised Statutes of 1950; Title 33, Section 1333; Title 40, Sections II.1 and 1299.36) --

The one provision of these short statutes of particular interest is that they expressly permit the entry of oil production waste material from offshore locations into the state for disposal in abandoned wells.

Chapter X, Sanitary Code, Sewerage and Waste Disposal - Refuse - Garbage - Rubbish - Ashes -- These regulations do not address industrial wastes. New regulations are being developed under the State's Solid Waste Management Plan which is in the jurisdiction of the Health and Human Resources Administration.

## Montana

Montana Refuse Disposal Regulations (Montana Administrative Codes: Title 16)--

These regulations also employ designations of Class I, II, and III disposal sites and of Groups 1, 2, and 3 wastes very much like the approach of California. Most geothermal process wastes would fall in Groups 1 and require Class I disposal. These sites are sanitary landfills which must not allow discharge of disposed materials or their byproducts to ground or surface waters. They must either confine the wastes to the disposal site with no likelihood that the wastes will escape or they must be situated in a location where the leachate from the wastes can only penetrate into underlying formations which have no hydraulic continuity with usable waters. Class I sites shall not be located where underlying geological formations contain rock fractures or features which might lead to pollution of underground waters.

The Division of Environmental Sanitation, Department of Health, both adopted and administers these regulations.

## Nevada

Regulations Governing Solid Waste Management --

These regulations were adopted by the Board of Health and are implemented by the Solid Waste Office in the Bureau of Environmental Health. They permit District Boards of Health and municipalities to adopt more restrictive standards for the location, design, construction, operation, and maintenance of solid waste disposal operations and to issue permits. Potentially hazardous materials may be deposited at land disposal sites only if provisions for such disposal are included in the operational plan and approved by the health authority. Hazardous liquid wastes are to be neutralized or solidified before disposal. Completed hazardous waste burial areas must be covered with a layer of suitable cover material compacted to a minimum uniform depth of 91 cm (36 in.).

## New Mexico

Solid Waste Management Regulations --
These regulations apply largely to disposal sites which are operated to receive the solid wastes of municipalities, counties, etc., and do not exclude any types of waste. In addition, a property owner may dispose of solid waste on his own property which is generated there if he disposes of it in a manner that does not create a nuisance or a hazard to health or pollute any body of water. They were adopted by the Environmental Improvement Board which also administers them.

## Oregon

Solid Waste Management, Chapter 340, Oregon Administrative Rules Compilation --
These regulations were adopted by the Environmental Quality Commission and are implemented by the Department of Environmental Quality. They include separate and very strict controls on the disposal of environmentally hazardous wastes. Disposal of these wastes is only permitted on real property owned by the state. A license is required which establishes minimum requirements for the disposal of hazardous wastes, limits as to types and quantities of materials, minimum requirements for operation, maintenance, monitoring, and supervision.

Anyone proposing to establish a hazardous waste disposal site must report in detail supporting information to justify the necessity for a site.

The disposal method required for other wastes is sanitary landfilling unless a modified landfill is authorized. The latter is a disposal by compaction in or upon the land and cover of all wastes deposited at specific designated intervals, but not necessarily each operating day. They must be located a minimum of 0.4 km (0.25 mi) from the nearest existing residence or commercial establishment other than that used by the landfill operation.

Leachate production is to be minimized and where required is to be collected and treated in an approved manner.

## Texas

Texas Water Quality Board Industrial Solid Waste Management Regulation --
These regulations, adopted and administered by the Department of Health Resources, also embrace the Class I, II, and III disposal site and Group 1, 2, and 3 wastes approach. They are also extended to cover shipping requirements to off-site disposal facilities. Wastes generators who dispose of Class I or II wastes on-site must maintain records on the quantity, character, and classification of the waste, and the method and location of disposal. For purposes of classifying waste materials, the Texas Water Quality Board may require a chemical analysis and a written description, or it may take samples of the waste for analysis, or both.

## Utah

Code of Solid Waste Disposal Regulations --

The Board of Health and the Water Pollution Committee adopted these regulations which are implemented by the Department of Science Services. They require that the design plan for a sanitary landfill disposal site include special provisions for handling special and/or hazardous wastes. These provisions are to include, where necessary, a separate area for such wastes designated by appropriate signs. Hazardous wastes are to be covered with 15.2 cm (6 in.) of cover material immediately after they are deposited.

The code is supplemented by a detailed interpretation of the hazardous and special waste disposal provisions which point out that such waste material is to be accepted for disposal on a case-by-case basis - i.e., based on type of wastes, volume, solubility, volatility, presence of noxious fumes, degradation rates, and other factors pertinent to immediate and long range protection. Radioactive wastes are not to be accepted at any landfill. One rather unusual provision is that when hazardous waste materials are refused for disposal, the generator should notify the State Division of Health since refusal may result in indiscriminate dumping at unauthorized localities.

## Washington

Regulations Concerning Solid Waste Management in Washington State WAC 16-34-010 - WAC H80-70-440 --

The Department of Ecology is both the promulgating and administering agency of these regulations. They define "disposal site" to include both sanitary landfills and dumps and other means of disposal. Pollution control measures are to be provided as follows:

1. Surface runoff water from around the disposal site and from roof drains shall be intercepted and diverted around or under the disposal site.

2. Surface runoff from the disposal operation itself shall not cause violation of applicable receiving water standards.

3. Groundwater pollution controls shall be provided as needed. The detailed plans for such controls shall be provided.

4. Air pollution and dust controls shall be provided as needed.

5. Open burning is prohibited.

6. Noise controls shall be provided as needed.

7. The disposal site shall be maintained in a reasonably clean and sanitary condition.

Pollution prevention measures include the determination on a case-by-case basis the minimum separation between the bottom of the fill and the highest groundwater when hazardous wastes are involved.

## Wyoming

Solid Waste Management Rules & Regulations --

The applicability of these regulations, adopted by the Environmental Quality Council, to the solid waste disposal practices of geothermal operators appears to be established by the section which applies the regulations to any "person," "corporation," "business trust," or "other entity" involved in any aspect of the management, control, or disposal of solid waste. This does not exempt disposal of solid wastes on one's own property. This is subsequently confirmed when "dumping" is limited to a single family unit or household on its own residential property subject to certain restrictions.

"Industrial landfill" and "hazardous waste facility" are among the various waste disposal operations separately classified. Both must have the approval of the Department of Environmental Quality to which construction and operating plans must be submitted. These plans must include area maps showing land use and/or zoning within 0.8 km (0.5 mi) of the proposed disposal site which are detailed enough to show all buildings, water wells, water courses, roads, and other applicable details. The information required for onsite operation are the common ones variously described above including geological formations and soils analysis, depth to the highest groundwater table, methods to protect surface and groundwater, treatment and recovery processes to be utilized, among others. However, one requirement is somewhat more explicit than in some other regulations. This includes "types, characteristics, and quantities of wastes to be handled at the site. Common, trade, and chemical names of ... the different materials (caustic, toxic, water soluble, flammable, solid, liquid, slurry, etc.), amounts per day, per month, per year."

The minimum operating standards for the industrial classification are somewhat less demanding than those for the hazardous classification. The minimum requirements for the latter include the following, among others:

1. All precautions must be taken to prevent unauthorized entry into the disposal site.

2. All sites must be located away from flood plains, natural depressions, and excessive slopes unless detailed engineering plans indicate acceptability.

3. Sites must not be located near any elements of drinking water supply.

4. Whenever possible, sites shall be located in areas of impermeable soils. (Emphasis is added to show difference between this more permissive requirement and the mandatory requirement of California and other states for impermeability.)

5. The site must be located and designed to a) contain any runoff from accidental spills and b) prevent hydraulic surface or subsurface connection between flowing or standing water.

6. All trenches, ponds, holding tanks, etc. must be lined so as to prevent leaching or transmission of materials from the site.

7. Records must be maintained on the amounts of wastes received, types according to chemical analysis, date received, and location.

8. Precautions must be taken to avoid mixing of incompatible material.

9. When the site is completed the working areas must be encapsulated to prevent the migration of the water into or out of the material.

There is a waiver provision which is especially important to geothermal operations. This permits the Department to grant waivers to the solid waste regulations which "are necessitated by reason of .. industrial operations remote from authorized solid waste disposal sites and which do not create a health hazard, public nuisance, or are not a detriment to the environment." This immediately precedes an exemption at oil drilling sites regulated by the Wyoming Oil and Gas Commission, USGS, and BLM.

NOISE REGULATION

As shown in Table V-13, five of the 15 states covered by this report have noise control statutes and three have regulations in this area. The documents are summarized below.

Other states, however, undertake to control noise emanating from geothermal operations in their special regulations governing geothermal development. These were discussed earlier in this section and are usually only general prohibitions with no specific standards.

California

Noise Control Act, West's Ann. Cal. Health and Safety Code Section 46000 et seq. --

This law established an Office of Noise Control within the Department of Health. No regulations have yet been filed, however.

Colorado

Title 25, Article 12, Noise Abatement --

This statute first prohibits noise which is objectionable because of intermittence, beat frequency, or shrillness. It then declares that sound levels at a distance of 8 m (25 ft) or more from a property line in excess of the following are prima facie evidence that the noise is a public nuisance:

| Zone | 7:00 am to next 7:00 pm dB(A) | 7:00 pm to next 7:00 am dB(A) |
|---|---|---|
| Residential | 55 | 50 |
| Commercial | 60 | 55 |
| Light Industrial | 70 | 65 |
| Industrial | 80 | 75 |

In the daytime, these noise levels may be increased by 10 dB(A) for a 15-minute period in any hour. Periodic, impulsive, or shrill noises are to be

## TABLE V-13. STATE STATUTES AND REGULATIONS
### Noise Control

| State | Statute | Regulations |
|---|---|---|
| Alaska | None | None |
| Arizona | None | None |
| California | Noise Control Act (West's Ann. Cal. Health and Safety Code Sec. 46000 et seq. | None |
| Colorado | Title 25, Article 12, Noise Abatement | No state regulations. Some adopted at local level. |
| Hawaii | Environmental Laws and Regulations. Vol. 1, Part IV | |
| Idaho | None | None |
| Louisiana | None | None |
| Montana | None | None |
| Nevada | None | None |
| New Mexico | None | None |
| Oregon | Oregon Environmental Laws, Chapter 467 | Noise Control Regulations, Chapter 340, Oregon Administrative Rules |
| Texas | None | None |
| Utah | None | None |
| Washington | Noise Control Act of 1974, Chapter 70, 107 RCW | Maximum Environmental Noise Levels, Chapter 173-60, WAC |
| Wyoming | None | None |

considered a public nuisance when they are 5 dB(A) less than those shown above.

## Hawaii

Community Noise Control for Oahu Public Health Regulations, Chapter 44B -- These regulations, promulgated and administered by the Department of Health, prohibit "excessive" noise at or beyond property lines. Allowable noise levels at the property line are as follows:

| Zoning Districts | Daytime 7 am to 10 pm dB(A) | Nighttime 10 pm to 7 am dB(A) |
|---|---|---|
| Residential | 55 | 45 |
| Preservation | 55 | 45 |
| Apartment | 60 | 50 |
| Hotel | 60 | 50 |
| Business | 60 | 50 |
| Agricultural | 70 | 70 |
| Industrial | 70 | 70 |

"Excessive noise" means any sound or sequence of sounds which exceeds these levels more than 10 percent of the time in any 20-minute period. An exception is that the allowable noise level for impulsive noise is 10 dB(A) above the levels in the table. Impulsive noise is defined as any sound with a rapid rise and decay of sound pressure level, lasting less than one second, caused by sudden contact between two or more surfaces or by a sudden release of pressure. On-site vehicles or construction equipment which requires an exhaust of gas or air must be muffled.

The Director of the Department of Health may grant permits to operate equipment which emits noise in excess of the above limits under certain conditions such as when the activities are temporary and cannot be delayed to a time period in which they would be permitted. There are the following limitations on permits for construction activities, however:

1. No permit shall be granted for construction activities creating excessive noise when measured at or beyond the property line for the hours before 7:00 am and after 6:00 pm of the same day.

2. Construction activities which emit noise in excess of 95 dB(A) at or beyond the property line of the construction site shall be restricted to the hours between 9:00 am and 5:30 pm of the same day.

3. Construction activities which exceed the allowable noise levels shall be prohibited on Sundays and on the following holidays: New Year's Day, President's Day, Memorial Day, Kamehameha Day, Independence Day, Labor Day, Discoverer's Day, Veteran's Day, Thanksgiving Day, and Christmas Day. Activities exceeding 95 dB(A) shall be prohibited on Saturdays.

These regulations presently apply to Oahu only but it can be expected that activities which would create excessive noise in the more pristine islands would be subjected very quickly to similar requirements.

Oregon

Noise Control Regulations (Chapter 340, Oregon Administrative Rules Compilation --

Noise levels generated by new industrial noise sources are limited to the following levels:

Allowable Statistical Noise Levels in Any One Hour

| 7 am - 10 pm | 10 pm - 7 am |
|---|---|
| $L_{50}$ - 55 dB(A) | $L_{50}$ - 50 dB(A) |
| $L_{10}$ - 60 dB(A) | $L_{10}$ - 55 dB(A) |
| $L_1$ - 75 dB(A) | $L_1$ - 60 dB(A) |

"Statistical Noise Level" means the noise level which is equalled or is exceeded a stated percentage of the time. An $L_{10}$ - 65 dB(A) implies that in any hour of the day 65 dB(A) can be equalled or exceeded only 10 percent of the time, or for six minutes.

Notwithstanding the allowable levels in the table, a new industrial noise source may not be operated on property previously unoccupied by an industrial source if the noise levels generated will increase the ambient statistical noise levels, $L_{10}$ or $L_{50}$, in any one hour by more than 10 dB(A) as measured at an appropriate point.

"Quiet Areas" may be established in wilderness areas, national and state parks, game reserves, or similar areas where the following limitations will apply:

| 7 am - 10 pm | 10 pm - 7 am |
|---|---|
| $L_{50}$ - 50 dB(A) | $L_{50}$ - 45 dB(A) |
| $L_{10}$ - 55 dB(A) | $L_{10}$ - 50 dB(A) |
| $L_1$ - 60 dB(A) | $L_1$ - 55 dB(A) |

Notwithstanding the above rules, the operation of an industrial noise source which emits an impulse sound in the air, as measured at the appropriate point, which has a peak sound pressure level in excess of 100 dB during the hours 7 am to 10 pm and 80 dB between the hours 10 pm and 7 am is prohibited. "Impulse sound" is defined as either a single pressure peak or a simple burst (multiple pressure peaks) for a duration of less than one second as measured on a peak unweighted sound pressure measuring instrument.

When the Department of Environmental Quality believes that the levels in the above tables do not adequately protect the public health, safety, or welfare, the Department may prohibit the operation of a noise source if the operation generates octave bands sound pressure levels which exceed the following:

### Allowable Octave Band Sound Pressure Levels

| Octave Band Center Frequency, Hz | 7 am - 10 pm | 10 pm - 7 am |
|---|---|---|
| 31.5 | 68 | 65 |
| 63 | 65 | 62 |
| 125 | 61 | 56 |
| 250 | 55 | 50 |
| 500 | 52 | 46 |
| 1000 | 49 | 43 |
| 2000 | 46 | 40 |
| 4000 | 43 | 37 |
| 8000 | 40 | 34 |

The regulations go on to set still further highly technical alternative restrictions which may be imposed under certain conditions.

The "appropriate measurement point" means one of two points on the noise sensitive property, whichever is further from the noise source -- i.e., 8 m (25 ft) toward the noise source from that point on the noise sensitive building nearest the noise source, or the point on the noise sensitive property line nearest the noise source.

Measurement methods will be prescribed and monitoring may be required.

Sounds created at construction sites are exempt.

## Washington

Maximum Environmental Noise Levels Chapter 173-60 WAC --
These regulations establish "environmental designations for noise abatement" (EDNA), the areas or zones within which the maximum permissible noise levels are established. Typically, Class A EDNA embrace property used for human habitation (including camps, parks, etc.); Class B are lands involving uses requiring protection against noise interference with speech (hotels, restaurants, retail and commercial services, theatres, stadiums, etc); Class C includes warehouse, industrial, agricultural, and similar areas.

The maximum permissible noise levels intruding into the property of another are as follows:

| EDNA OF NOISE SOURCE | EDNA OF RECEIVING PROPERTY | | |
|---|---|---|---|
| | Class A | Class B | Class C |
| CLASS A | 55 dB(A) | 57 dB(A) | 60 dB(A) |
| CLASS B | 57 | 60 | 65 |
| CLASS C | 60 | 65 | 70 |

These are subject to the following exceptions:

1. Between the hours of 10:00 pm and 7:00 am the noise limitations of

the foregoing table shall be reduced by 10 dB(A) for receiving property within Class A EDNAs.

2. At any hour of the day or night the applicable noise limitations in (a) and (b) above may be exceeded for any receiving property by no more than:

   a. 5 dB(A) for a total of 15 minutes in any one-hour period; or

   b. 10 dB(A) for a total of 5 minutes in any one-hour period; or

   c. 15 db(A) for a total of 1.5 minutes in any one-hour period.

Sounds resulting from construction are exempt except in Class A EDNAs between 10:00 pm and 7:00 am. Such sounds are to be covered in new standards.

Nothing in the regulations precludes required installation of the best available noise abatement technology consistent with economic feasibility. Nor are local governments prohibited from preventing noise as a nuisance.

Enforcement will be undertaken only on the complaint of a person affected by the noise. Any required measurement is to be conducted with a sound level meter at any point within the receiving property.

The state encourages noise control at the local level and the Department of Ecology will not engage directly in enforcement when a local government has an approved program.

# SECTION VI

# COUNTY GEOTHERMAL REGULATIONS

The final or draft documents of nine counties in California and one in Oregon which undertake to regulate geothermal development within their borders are summarized below. These include Sonoma County (site of The Geysers), Napa, Imperial, Plumas, Mono, Modoc, Inyo, Lassen, and Lake Counties in California and Malheur County in Oregon. It is understood that use permits are also required for geothermal development in Eureka, Churchill, and Washoe Counties in Nevada and Box Elder County in Utah [19].

## SONOMA COUNTY, CALIFORNIA

A new county geothermal ordinance is being drafted within the Sonoma County Planning Department. It is not completed and is not available at this time.

The County, according to a Planning Department source, has been handling geothermal development through its Zoning Ordinance (Chapter 26, Sonoma County Code) and an Ordinance Adopting Procedures for Implementing the (California) Environmental Quality Act of 1970 (Ordinance No. 1628, as amended).

The zoning ordinance establishes various types of districts in which specific uses of land and buildings are permitted or prohibited. In most districts, certain uses are permitted without a permit and a permit is required for others. The removal of minerals is permitted in any district with the exception that no geothermal activity other than exploratory drilling or leasing may occur in the districts which are designated Exclusive Agricultural. This type of district was set aside to implement the California Land Conservation Act of 1965 to preserve land for the commercial production of agricultural commodities. A use permit is required for mineral extraction.

In addition, public utility transmission lines, both overhead and underground, are permitted in all districts without a use permit, provided the Planning Commission reviews and approves the routes. Similarly, the public roads or highways, sewer and wastewater lines and accessory facilities, water supply lines and accessory facilities, and drainage channels or pipes are permitted in all districts subject to compliance with other county regulation of such activities.

The county's environmental impact report procedures provide several ways of defining a "Private Project" as a first step in determining whether an EIR is required for the proposed activity. In line with the state EIR guidelines, these are primarily projects for which some kind of county approval -- license, certification, use permit, etc. -- is required. In this way, geothermal production is defined as a "private project" by virtue of the necessity for a use permit. The attendant activities listed above also require various state/county certifications which also place them under the EIR umbrella.

The procedures for determining the eligibility of a project for EIR preparation are, of course, also in line with the state guidelines since the counties are presently acting as lead agencies under the guidelines. The ascending order of decision-making EIR authority is the county Planning Director, Environmental Protection Committee (made up of representatives of various county departments), and the cognizant planning agency (in the case of geothermal production, the Board of Zoning Adjustment). The opportunity for public comment is provided on both negative declarations (no EIR needed) and on the draft EIR's. It is the Planning Director's responsibility to prepare the EIR or have it prepared by an outside consultant. To the contrary of requiring approval or disapproval of a project no later than a given period, action may not be taken by the Board for approximately a month after a negative declaration or EIR is filed.

## NAPA COUNTY, CALIFORNIA

The Napa County Conservation, Development, and Planning Department has drafted a proposed ordinance dealing with geothermal development. The draft is entitled:

> An ordinance of the Board of Supervisors of the County of Napa, State of California, Regulating the Use of Land for Certain Exploration and Development Activities for Oil, Gas and Geothermal Resources, by Use Permit Within the County of Napa; Providing Bonding and Insurance Requirements in Connection With Such Permit.

The ordinance would establish procedures for the exploration and possible development and conservation of geothermal steam, associated geothermal resources, and/or hot water; the prevention of waste; the protection of the public interest; and the protection of air and water quality and other environmental qualities.

### Use Permits

Two types of use permits are authorized. The first is for temporary exploratory holes under 150 m (500 ft) in depth which must be sealed within 90 days from the time drilling begins. The other is for a geothermal exploration or development project which involves wells deeper than 150 m (500 ft) and/or geophysical and geologic exploratory operations, construction of roads, power plants, steam or electrical transmission lines, or other appurtenant features.

The applications for both types of permits require proof that all test measurements and waste discharge programs have been submitted to and are being processed by the Regional Water Quality Board. Other provisions of both require information relating to proposed land use and land contour. The exploration and development permit application also requires a description of the noise attenuation program to be employed, including estimates of sound pressure levels, scale and frequency bands which are expected from generators, air compressors, blooie lines, clean-out, and test operations after attenuation. A tentative plan must also be filed which shows the size and location of power generation, mineral extraction, desalination, pumping stations, and other surface facilities including their relationship to known geological fault zones.

A use permit would be issued subject to the terms and conditions that the Conservation, Development, and Planning Commission feels necessary to insure adequate protection of the public interest. These may include, but are not limited to, the categories of pesticides, herbicides, water quality control, sanitation and waste disposal, land subsidence, seismic activity, aesthetics, fish and wildlife, antiquities and historical sites, and restoration. Such conditions to the project will be attached by reference to the EIR.

## Denial of Permits

The bases for permit denial are so comprehensive that it is felt that they warrant full reproduction here. The Commission will be required to deny any application if it finds any of the following:

"A. Adequate mitigation measures do not exist for all forms of air, land, water and noise pollution, including, but not limited to, the control of erosion and the disposal of liquid, solid and gaseous wastes, protection of surface and sub-surface waters, plants, humans, fish and wildlife and their habitats.

"B. The establishment, operation and maintenance or the use of building applied for, will, under the circumstances of the particular case, be materially detrimental to the health, safety, peace, comfort, and general welfare of persons residing or working in the vicinity of the use, or the general welfare of the County will be endangered by damage to components of the ecological system such as vegetation, air, water, crops, household and agricultural water supplies from erosion increase, water quality degradation, groundwater infiltration, habitat loss, noise, dust, impact on fragile or sensitive areas, wildlife disturbance, impedance of wildlife movement, aesthetics disturbance, land use and cultural use disturbance, road failures, off-site land degradation, seepage, spillage, or escape of toxic materials, liquids or drill muds, venting or spillage of biosensitive materials, unacceptable sump materials dumping sites and neutralization of biosensitive sump materials, and system wide leakages or emissions due to breakdowns, punctures or vandalism, full or partial steam and gases vented to the atmosphere causing vegetation, crop, wildlife, aquatic organisms, domestic animals or human damage; and additional environmental changes of an air quality nature such as:

"1. Impact of potential acid rainfall and potential effect on vegetation, wildlife, aquatic organisms, human health, air chemistry, and agricultural production. Non-condensible gas status impact for carbon dioxide, methane, hydrogen, nitrogen, argon, mercury vapor, strontium, hydrogen sulfide, ammonia, ethane, radon, etc.

"2. Potential contributions to smog from photo-oxidation of hydrogen sulfide and ammonia. Probability of significant effects from dissemination of these substances as both gases and aerosols over Napa County, especially Napa, Pope, and Chiles Valley and Lake Berryessa. Evidence of effects are not known, are inconclusive or the acceptability limits are not known.

"3. Location and remote effects of increased levels of emissions from full field development arising from non-condensible gases and such other materials as boron, chlorides, heavy metals particularly mercury, lead, copper, etc., and radioactive materials such as radon and strontium or biota of all types in relation to standards such as EPA, State Health Department, etc.

"4. Premature condensation of moisture in air preventing thunderstorms in the Sierra Nevada and local climate modification such as increased fog and ice."

### Review of Permit

The proposed ordinance authorizes review of permits after one year and thereafter at intervals of not less than 36 months. The Commission may amend or revoke the permit if it finds that the permit "adversely affects the public health, safety, peace, morals, comfort and general welfare or the conditions above under 'Denial of Permits' are not being met."

## IMPERIAL COUNTY, CALIFORNIA

Imperial County has adopted a policy which will permit geothermal production projects in designated locations and under prescribed terms and conditions under an interim plan pending preparation of a final plan. The County has a study grant from the National Science Foundation to develop a geothermal element of the county general plan. The objectives of the plan are to:

1. Facilitate development of geothermal energy at feasible locations.

2. Mitigate undesirable environmental or social impacts of geothermal development.

3. Provide reasonable and effective regulation.

In addition to the plan, the project is to produce a document presenting research methodology and study results to be made available to other areas faced with the task of assessing impacts and formulating policy to control newly-developed energy resources. The University of California at Riverside (UCR) and the California Institute of Technology are working on specific task assignments under the grant. The environmental analysis, including a study of subsidence, is being conducted at UCR.

### Terms, Conditions, Standards, and Application Procedures for Initial Geothermal Development

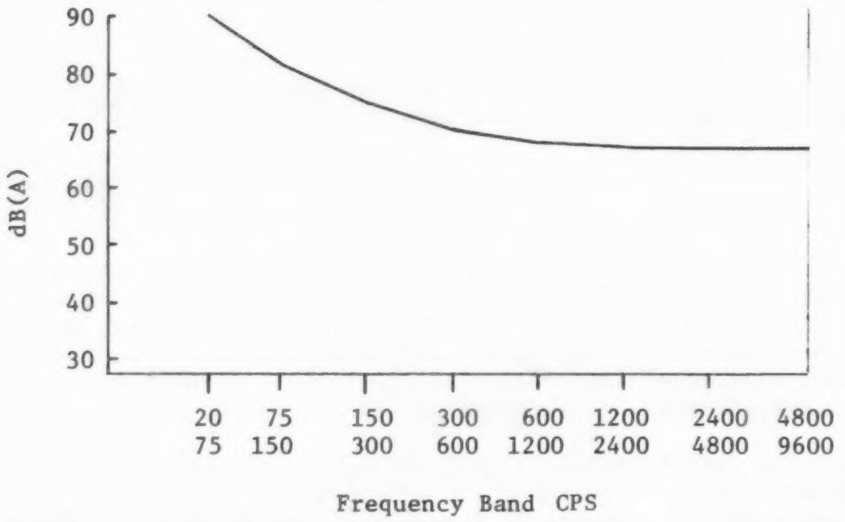
Water pollution control and solid waste disposal are handled in this document simply by stating that as a general condition all waste, whether liquid or solid, must be disposed of in compliance with existing county, state, and federal rules and regulations. Proof that all test and waste discharge information has been filed with the Regional Water Quality Control Board must accompany a permit application. The plans for all permanent sumps, brine ponds, and waste holding pools must be based on a soils investigation. Impervious or lined pool bottoms are required.

All operations shall be conducted in compliance with the requirements of the Imperial County Air Pollution Control Office. In addition, all operators are directed to take steps to insure that no harmful or obnoxious gases are released.

The site development and land use plan are to provide for maximum surface land usage including preservation of farm lands. As their participation in the Subsidence Detection Program operators are required to install a minimum of one permanent benchmark per well as directed by the County Surveyor. The operator is to tie this benchmark into the nearest point of USGS level net by first order leveling techniques.

The drilling and production standards are very specific on the regulation of noise. A graph is provided, shown here in Figure VI-1, which gives numerical limitations applicable to noise at the property boundary.

FIGURE VI-1. NOISE LEVEL LIMITATIONS FOR ALL GEOTHERMAL OPERATIONS IN IMPERIAL COUNTY, CALIFORNIA



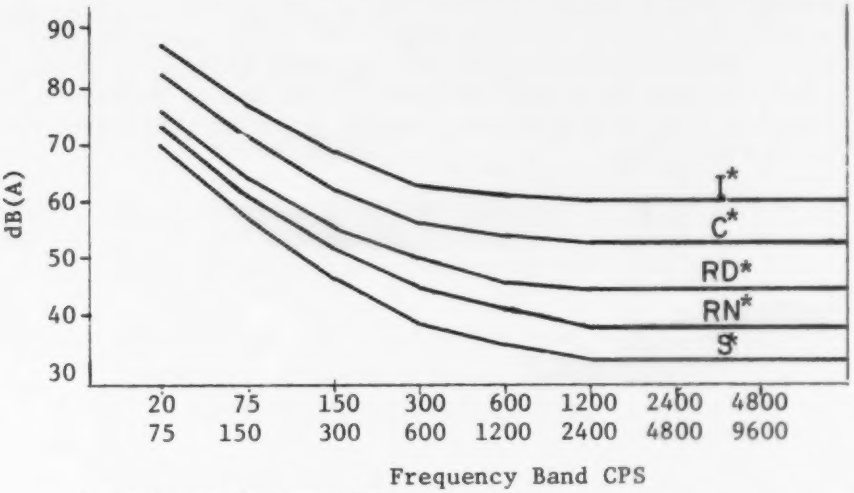
Operators adjacent to or near existing development must also conform to more stringent limitations. The graph shown in Figure VI-2 will be utilized and the planning commission will determine which curve will apply. The above

10 percent exception is also applicable.

All off-site collection pipelines are to be buried and in agricultural or potential agricultural areas, holding ponds must be purged of brine, salts removed, and the berms leveled to the satisfaction of the county.

Information is required in the permit application on the relationship of surface facilities to known active faults.

FIGURE VI-2. NOISE LEVEL LIMITATIONS FOR GEOTHERMAL OPERATIONS ADJACENT TO OR NEAR EXISTING DEVELOPMENT IN IMPERIAL COUNTY, CALIFORNIA



* Land use designations
I - industrial; C - commercial; RD - residential day;
RN - residential night; S - school area

PLUMAS COUNTY, CALIFORNIA

Plumas County deals with geothermal development through its zoning law. It is permitted in certain types of districts, usually subject to a Special Use Permit. Under "Uses Permitted" in each district, geothermal resources are mentioned as such only in the Exclusive Agricultural District. However, the county Planning Department indicates that geothermal activities are permitted in General Forest, General Agriculture, and Industrial Districts.

A special use permit issued in 1973 for a test geothermal well has some environmentally-related provisions which appear to be unique. One is that the permit does not commit the county to future development of the geothermal field, approval of which depends upon a review of information on the significant reservoir parameters supplied when testing is completed. This information should include the following:

a. Temperature
b. Rate of extrusion
c. Ratio of gas phase to fluid phase
d. Chemistry

    1. Noncompressible gases

        carbon dioxide
        hydrogen sulfide
        sulfur oxides
        argon
        oxygen
        ammonia
        hydrocarbons $C_1 - C_5$

    2. Total dissolved solids
    3. Total hardness
    4. Alkalinity
    5. pH
    6. Other
    7. Dissolved solids

        bicarbonate
        carbonate
        hydroxide
        chloride
        sulfate
        nitrate
        fluoride, fluorine
        iron
        manganese
        arsenic
        boron
        mercury
        sodium
        calcium
        magnesium
        potassium
        xenon
        other

This review will require an EIR addressed to the operator's entire leaseholding which establishes where and how the operator will create future wells and install generating facilities and transmission lines. It will also consider potential hazards to public safety and welfare and magnitudes of the impacts on wildlife, agriculture, water and air quality, and scenery. There is no specific designation as to who will prepare the EIR.

As a means of air pollution control, if field development is permitted, a closed production system will be required if a fluid phase geothermal system is encountered or a minimum 80 percent reinjection system if a gaseous phase system is present. The permit states that a newly developed closed system would be operational very soon, and an 80 percent reinjection system will probably be operational in two to four years.

The county also requires parallel development of agricultural use and electric power generation of any geothermal resources discovered in order to maintain its agricultural economy. This subject was to be addressed in the EIR along with the county's intention to establish, presumably on the operator's leasehold, an ecological reserve for the protection of the habitat of migrant waterfowl which would exclude geothermal operations. The county also retained the authority to suspend site operations should unforeseen effects on waterfowl be ascertained.

A permit is required from the county Air Pollution Control District prior to well extension operations and air drilling operations, if employed. No other reference is made to air pollution control.

Similarly no water quality or effluent standards are prescribed, but some specific water pollution control requirements are imposed. These include the confinement of all drilling mud, rock cuttings, and extruded fluids to steel leak-proof containers; immediate notification to the county environmental planner in the event of fluid spillage no matter what quantity; no interference with established drainage patterns and water courses, and discontinuance of operations during excessive rainfall and flood periods if health and safety hazards are indicated. In addition, the operator is directed to transport extruded geothermal fluids to the nearest Class I landfill (described under California state regulations) if they are refused in Washoe County, Nevada.

Diesel mufflers are required to reduce drilling noise and the following noise-level standards are established:

a. Noise shall not exceed 65 dB(A), USA Standards Institute Criteria, at any human habitation (in this case, at the nearest ranch buildings).

b. Noise shall not exceed 90 dB(A) at the well site.

Another provision of the use permit which appears unique is that the operator is directed to furnish an accurate measurement of well-site soil shrink-swell potential and bearing capacity and to provide an engineering design for the well-site pad that describes anticipated static and dynamic loads and justifies the calculated foundation design. Pursuant to approval of the County Planning Director, the operator shall then construct such foundation (excavation and engineered backfill, engineered ballast, etc.) as indicated by the study.

## MONO COUNTY, CALIFORNIA

The Mono County Department of Planning advised that with the establishment of a KGRA within its borders and the drillings of two exploratory wells in the early 1970's that it was felt necessary to establish county policy and regulations looking toward geothermal development. Since that time, however, the Department has experienced the inability to exercise any local jurisdiction because of what its spokesman described as "multiple layers of federal bureaucracy." Seventy-nine percent of the land in the county is federally-owned. The Department's role, according to the spokesman, has been limited to that of defendant in law suits filed by environmentalists.

The county's position now is that it is without jurisdiction on public lands and that the cognizant federal and state agencies must be responsible for their actions in these areas.

Geothermal development on private land is subject to Conditional Use Permits which are obtained on the merit of the individual application. The permits are structured to permit amendments or additions to the conditions as the need arises. It has been found that a rigid set of regulations which attempts to cover all situations throughout the county becomes so burdensome to both the applicant and the regulatory agency that it becomes unmanageable. The Department feels that this approach results in under-restrictive or over-restrictive regulations for any given situation.

## MODOC COUNTY, CALIFORNIA

The Modoc County "Terms, Conditions, Standards and Application Procedures for Initial Geothermal Development" are virtually identical to those of Imperial County. The only significant differences are that: (1) data prepared by a permit applicant for submission to state and federal agencies may be substituted for information required by Modoc County if the data adequately fill the requirements; and (2) the noise standard is much less specific in that it only prohibits noise levels that will create a nuisance to nearby residents.

## INYO COUNTY, CALIFORNIA

The Geothermal Ordinance of Inyo County (Ord. 239, Section 1.20, 1973) is also very similar to the Imperial and Modoc County documents although its effects may be somewhat more restrictive. This is because certain requirements that apply only in previously developed areas in the other counties are applicable countywide in Inyo County. There is one important addition in the Inyo ordinance, however. This is a more detailed subsidence and earth movement study which requires annual measurement and reporting of information gained from benchmarks in a grid. If any subsidence or earth movement is detected, the County Surveyor will specify the measurement and report schedule.

An operator is also required to participate in a hot springs protection program. This involves mapping all known or possible hot springs and filing a report before the first exploratory well is drilled on the volume, rate of flow, chemical composition, temperature, and other pertinent data on the spring. Surveys of the wells are to be conducted at two-month intervals for the first two years of a conditional use permit. If no adverse effects are revealed, the survey period is extended to every six months. If adverse effects appear to be of a permanent nature, the operator will be instructed to begin a program to return the affected hot spring to its original state.

It was pointed out by an Inyo County spokesman that the Department of

Water and Power of the City of Los Angeles is the fee owner of a considerable amount of land in the county. Theoretically, he said, although Inyo County does not concede the applicability, the use of this land could be subject to regulation by the Los Angeles City Council or Board of Water and Power Commissioners. While the resolution of this question is beyond the scope of this study, it does point up another type of uncertainty which may surround a potential geothermal developer's operations.

## LASSEN COUNTY, CALIFORNIA

Geothermal wells are permitted in any zoning district of Lassen County with the acquisition of a conditional use permit. An applicant first submits a preliminary environmental questionnaire which provides the basis for the county decision as to whether an EIR is required. Once the EIR procedure is completed in accord with the state guidelines, the applicant files a very brief application for his conditional use permit.

## LAKE COUNTY, CALIFORNIA

### Proposed Geothermal Development Ordinance

A proposed Geothermal Development Ordinance is pending in Lake County. Under its provisions geothermal development is permitted in Class A areas which are not defined except that they are suitable for geothermal development. Geothermal activities are permitted in Class B -- residential and recreation -- areas with the observance of special conditions, but are prohibited in scenic areas. The County Planning Commission is given the supervisory authority over geothermal development under use permits. Each permit is to be individually conditioned in addition to the blanket conditions set by the proposed ordinance; use permits are also conditional subject to review and potential amendment every six months. In addition to a general provision that all well drilling, plants and power line construction, testing, and production will not conflict with public health, safety, comfort, convenience, and general welfare, some very specific environmental constraints are applied. Noise levels are restricted as follows:

| | Sound Pressure in Decibels ("A" Scale) | |
|---|---|---|
| Cycles per second | Class A Areas | Class B Areas |
| Below 75 | 80 | 65 |
| 75-150 | 75 | 60 |
| 150-300 | 70 | 55 |
| 300-600 | 64 | 55 |
| 600-1200 | 58 | 45 |
| 1200-2400 | 53 | 45 |
| 2400-4800 | 49 | 40 |
| Above 4800 | 46 | 40 |

If the noise is not smooth and continuous and is not radiated between the hours of 9 p.m. and 7 a.m., one or more of the corrections given below shall be added to or subtracted from each of the specified decibel levels.

Noise source operated less than 20% of any one-hour period; +5

Noise source operated less than 5% of any one-hour period; +10

Noise source operated less than 1% of any one-hour period; +15

Noise of impulsive character (hammering, etc.) -5

Noise of periodic character (hum, screech, etc.) -5

Noise present at between the hours of 10 p.m. and 7 a.m. on Monday through Saturday or at anytime on Sunday or Holidays; -7

(from National Institute of Municipal Law Officers Model Noise Ordinance)

Other noise-related restrictions are also imposed. The most effective muffling equipment available must be applied at all times to drilling, cleanout, well testing, and producing operations, and compressors must be located and screened to minimize noise and vibration.

In addition to requiring that air emissions from all geothermal activities conform to state and county ambient air quality standards, a flat prohibition is placed on the emission of hydrogen sulfide, ammonia, or other noxious odors. All venting steam, steam condensate, or water discharges are to be monitored periodically by a county Geothermal Control Officer for carbon dioxide, ammonia, sulfur dioxide, hydrogen sulfide, $CH_4$, mercury, arsenic, boron, or other substances at the discretion of the Control Officer. The operator is required to pay the cost of monitoring equipment and county personnel utilized. Where injection is practiced, wells and springs specified by the Control Officer must be chemically analyzed prior to injection and yearly as long as injection continues.

A minimum of two adjoining and connecting sumps must be provided to collect all drilling effluent with no overflow, to be analyzed at the discretion of the Control Officer. Environmentally harmful effluents must be removed by truck to an approved location for disposal. Lining for temporary sumps may be required, and permanent sumps or holding ponds must have a natural impervious bottom or must be lined.

Operators are required to cooperate in subsidence and fault monitoring and other county, state, or federal protection programs. In residential and recreational areas, all geothermal steam or fluid transmission lines must be buried. Minimum distances to be observed in situating wells or other installations are as follows:

| | |
|---|---|
| Lakes, streams, or permanent waterways | 90 m (300 ft) |
| Outer boundaries of land parcels under geothermal development | 30 m (100 ft) |
| Public roads | 30 m (100 ft) |

### Conditions, Procedures and Performance Standards for Geothermal Regulation

In addition to these standards, the county issues geothermal use permits in which environmental restraints are imposed. Before work may commence under the terms of a permit, written approval must be obtained from the California Regional Water Quality Office. The operator is required to cooperate with county departments or the Planning Commission in developing a "geothermal element" for the county's master plan. The Planning Commission may deny a permit application if it is not compatible with the land use elements of the general plan.

All wastes, liquid or solid, must be disposed of in compliance with existing county, state, and federal rules and regulations. No waste is permitted to enter any stream or other body of water. All drilling wastes must be removed from the site within 60 days and disposed of in accordance with state and county water quality regulations. All sumps and/or ponds must be purged of environmentally harmful materials, filled and packed with native earth, and replanted to county landscaping standards. Pond bottoms and dykes must either be impervious or lined.

Noise is to be limited generally to 65 decibels at a distance of 0.8 km (0.5 mi) from the drill site and in restricted areas (designated by the Planning Commission) to 50 decibels at a distance of 152 m (500 ft). The minimum distances to be observed in siting a well are:

| | | |
|---|---|---|
| 1. | Outer boundary of parcel | 30 m (100 ft) |
| 2. | Public roads | 30 m (100 ft) |
| 3. | Residence | 150 m (500 ft) |
| 4. | School | 805 m (2640 ft) |
| 5. | Hospital | 1600 m (5280 ft) |
| 6. | Any other development | 150 m (500 ft) |

Air pollution emissions are subject to the Lake County Zoning Ordinance #645 which invokes the state ambient air quality standards. No emissions of pollutants not specified by the standards are permitted which result in concentrations at the lot line which are readily detectable when diluted in the ratio of one volume of odorous air to four volumes of clean air.

### Use Permits

The use permits issued by Lake County for geothermal development are highly specific and detailed in the environmental protection restraints imposed. An example is shown in Appendix M. According to a county spokesman, these restraints are a direct result of the state environmental impact report process.

It will be noted that certain sections of the permit are designed to protect surface land and/or prevent erosion and stream siltation. In addition to mandating some specific standard procedures for controlling run-off, the permit requires county approval of drill pad locations in areas of not more than an average of 30 percent natural slope and for use of explosives for steam well stimulation. It is notable that these refer only to surface hazards and not to sub-surface.

It is also noted that, subject to the findings of the county's spot monitoring, the operator may be required to install continuous air quality monitoring and/or noise level monitoring equipment. Three wells were ordered to be relocated to avoid adverse geologic soils and view impact.

In accordance with environmental impact report considerations the permit directs specific ecological protection aspects -- i.e., plants, wildlife, air, noise, and scenery in addition to soil. Some general requirements are included, many of which are incorporated in the above proposed ordinance or performance standards. Others include county permission to drill within 150 m (500 ft) of a creek flowing 10 months or more during the year and a prohibition on discharging hydrocarbon-based cleaning compounds or oils or grease on the surface of a drill pad. All liquids of this type are to be contained and removed from the site.

## MALHEUR COUNTY, OREGON

These regulations are almost identical to those of Imperial County, California, incorporating the very specific noise limitations.

## SECTION VII

## REFERENCES

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3. Final Order and Decree Pursuant to Civil Actions No. 2153-73, 75-0172, 75-1698, 75-1267, Natural Resources Defense Council, Inc., et al., Environmental Defense Fund, et al., Citizens for a Better Environment, et al., v. Russel E. Train, Defendant and Natural Resources Defense Council, Inc. v. James I Agee, et al., Defendants, in the U.S. District Court for the District of Columbia, March 30 (1976).

4. Development Document for Effluent Limitations Guidelines and New Source Performance Standards for the Steam Electric Power Generating Point Source Category, EPA 440/1-74 029-a, October (1974).

5. National Power Plant Team, U.S. Fish and Wildlife Service, EPA/NRC/FWS 316(a) Technical Guidance Manual and Guide for Thermal Effects of Nuclear Power Plant Environmental Impact Statements - A First Step Towards Standardizing Biological Data Requirements for the EPA-NRC Memorandum of Understanding, December 11, (1975). (Draft)

6. Rogers, W. F., Composition and Properties of Oil Well Drilling Fluids, 3rd Ed., Gulf Publishing Co., Houston (1963).

7. Gosselin, R. E., et al., Clinical Toxicology of Commercial Products, 4th Ed., Williams & Wilkins Co., Baltimore (1976).

8. Office of the Secretary, Final Environmental Statement for the Geothermal Leasing Program, Department of the Interior (1973).

9. Geothermal Energy, Jan. (1975).

10. Linton, A. M., "Innovative Geothermal Uses in Agriculture, Proceedings of the International Conference on Geothermal Energy for Industrial, Agricultural, and Commercial-Residential Uses, Multipurpose Use of Geothermal Energy, Klamath Falls, Oregon (1974).

11. Statement of Burmah Oil and Gas Company before the California State Lands Commission, Subcommittee on Geothermal Resources, San Francisco, September 25 (1975).

12. Preliminary statement of Dr. Carel Otte, Union Oil Co. of California before the California State Lands Commission Subcommittee on Geothermal Resources, Los Angeles, September 17; San Francisco, September 25 (1975).

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14. Statement of Northern California Power Agency, ibid.

15. Shackelford, B. W., "PG and E Experience in Development of The Geysers Power Plant, Factors Which Have Caused Delays," ibid.

16. Quality Criteria for Water, EPA, Pre-Publication Copy (1976).

17. Public Health Service, Drinking Water Standards, U.S. Dept. of Health, Education, and Welfare (1962).

18. National Interim Primary Drinking Water Regulations, EPA, Federal Register, Dec. 24 (1975).

19. Program Definition for the Development of Geothermal Energy, Vol. III: Appendices, Jet Propulsion Laboratory, California Institute of Technology, Pasadena (1975).

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| FOR AGENCY USE |
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## APPENDIX A

### NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
### APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER

## STANDARD FORM C – MANUFACTURING AND COMMERCIAL

### SECTION I. APPLICANT AND FACILITY DESCRIPTION

Unless otherwise specified on this form all items are to be completed. If an item is not applicable indicate 'NA.'

ADDITIONAL INSTRUCTIONS FOR SELECTED ITEMS APPEAR IN SEPARATE INSTRUCTION BOOKLET AS INDICATED. REFER TO BOOKLET BEFORE FILLING OUT THESE ITEMS.

*Please Print or Type*

1. **Legal Name of Applicant** (see instructions) — 101 ____________________

2. **Mailing Address of Applicant** (see instructions)
   - Number & Street — 102a ____________________
   - City — 102b ____________________
   - State — 102c ____________________
   - Zip Code — 102d ________

3. **Applicant's Authorized Agent** (see instructions)
   - Name and Title — 103a ____________________
   - Number & Street Address — 103b ____________________
   - City — 103c ____________________
   - State — 103d ____________________
   - Zip Code — 103e ________
   - Telephone — 103f ______ Area Code ______ Number

4. **Previous Application** If a previous application for a National or Federal discharge permit has been made, give the date of application. Use numeric designation for date. — 104 ___ YR ___ MO ___ DAY

I certify that I am familiar with the information contained in this application and that to the best of my knowledge and belief such information is true, complete, and accurate.

____________________ Printed Name of Person Signing — 102e ____________________ Title

____________________ Signature of Applicant or Authorized Agent — 102f ___ YR ___ MO ___ DAY Date Application Signed

*18 U.S.C. Section 1001 provides that:*

*Whoever, in any matter within the jurisdiction of any department or agency of the United States knowingly and wilfully falsifies, conceals or covers up by any trick, scheme, or device a material fact, or makes any false, fictitious or fraudulent statement or representation, or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than five years, or both.*

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Received ___ YR ___ MO ___ DAY

OFFICE: ____ EPA Region Number

____ State

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This section contains 3 pages.

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**5. Facility/Activity (see instructions)** Give the name, ownership, and physical location of the plant or other operating facility where discharge(s) does or will occur.

Name 105a ______

Ownership (Public, Private or Both Public and Private) 105b ☐ PUB ☐ PRV ☐ BPP

Check block if Federal Facility and give GSA Inventory Control Number 105c ☐ FED

105d ______

Location

Street & Number 105e ______

City 105f ______

County 105g ______

State 105h ______

**6. Nature of Business** State the nature of the business conducted at the plant or operating facility. 106a ______

106b AGENCY USE ☐

**7. Facility Intake Water** (see instructions) Indicate water intake volume per day by sources. Estimate average volume per day in thousand gallons per day.

Municipal or private water system 107a ______ thousand gallons per day

Surface water 107b ______ thousand gallons per day

Groundwater 107c ______ thousand gallons per day

Other* 107d ______ thousand gallons per day

Total Item 7 107e ______ thousand gallons per day

*If there is intake water from 'other,' specify the source. 107f ______

**8. Facility Water Use** Estimate average volume per day in thousand gallons per day for the following types of water usage at the facility. (see instructions)

Noncontact cooling water 108a ______ thousand gallons per day

Boiler feed water 108b ______ thousand gallons per day

Process water (including contact cooling water) 108c ______ thousand gallons per day

Sanitary water 108d ______ thousand gallons per day

Other* 108e ______ thousand gallons per day

Total Item 8 108f ______ thousand gallons per day

*If there are discharges to 'other,' specify. 108g ______

If there is 'Sanitary' water use, give the number of people served. 108h ______ people served

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**9. All Facility Discharges and other Losses; Number and Discharge (see instructions) Volume** Specify the number of discharge points and the volume of water discharged or lost from the facility according to the categories below. Estimate average volume per day in thousand gallons per day.

| | | Number of Discharge Points | | Total Volume Used or Discharged, Thousand Gal/Day |
|---|---|---|---|---|
| Surface Water | **109a1** | | **109a2** | |
| Sanitary wastewater transport system | **109b1** | | **109b2** | |
| Storm water transport system | **109c1** | | **109c2** | |
| Combined sanitary and storm water transport system | **109d1** | | **109d2** | |
| Surface impoundment with no effluent | **109e1** | | **109e2** | |
| Underground percolation | **109f1** | | **109f2** | |
| Well Injection | **109g1** | | **109g2** | |
| Waste acceptance firm | **109h1** | | **109h2** | |
| Evaporation | **109i1** | | **109i2** | |
| Consumption | **109j1** | | **109j2** | |
| Other* | **109k1** | | **109k2** | |
| Facility discharges and volume Total Item 9. | **109l1** | | **109l2** | |

*If there are discharges to 'other,' specify. **109m1** ______________________

**10. Permits, Licenses and Applications**
List all existing, pending or denied permits, licenses and applications related to discharges from this facility (see instructions).

| | Issuing Agency | For Agency Use | Type of Permit or License | ID Number | Date Filed YR/MO/DA | Date Issued YR/MO/DA | Date Denied YR/MO/DA | Expiration Date YR/MO/DA |
|---|---|---|---|---|---|---|---|---|
| **110** | **(a)** | **(b)** | **(c)** | **(d)** | **(e)** | **(f)** | **(g)** | **(h)** |
| 1. | | | | | | | | |
| | | | | | | | | |
| 2. | | | | | | | | |
| | | | | | | | | |
| 3. | | | | | | | | |
| | | | | | | | | |

**11. Maps and Drawings**
Attach all required maps and drawings to the back of this application.(see instructions)

**12. Additional Information**

| **112** Item Number | Information |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |

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GPO 865-708

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## STANDARD FORM C – MANUFACTURING AND COMMERCIAL

### SECTION II. BASIC DISCHARGE DESCRIPTION

Complete this section for **each** discharge indicated in Section I, Item 9, that is to surface waters. This includes discharges to municipal sewerage systems in which the wastewater does not go through a treatment works prior to being discharged to surface waters. Discharges to wells must be described where there are also discharges to surface waters from this facility. **SEPARATE DESCRIPTIONS OF EACH DISCHARGE ARE REQUIRED EVEN IF SEVERAL DISCHARGES ORIGINATE IN THE SAME FACILITY.** All values for an existing discharge should be representative of the twelve previous months of operation. If this is a proposed discharge, values should reflect best engineering estimates.

ADDITIONAL INSTRUCTIONS FOR SELECTED ITEMS APPEAR IN SEPARATE INSTRUCTION BOOKLET AS INDICATED. REFER TO BOOKLET BEFORE FILLING OUT THESE ITEMS.

1. **Discharge Serial No. and Name**
   - a. **Discharge Serial No.** (see instructions) — **201a** ______
   - b. **Discharge Name** Give name of discharge, if any. (see instructions) — **201b** ______________________________
   - c. **Previous Discharge Serial No.** If previous permit application was made for this discharge (see Item 4, Section I), provide previous discharge serial number. — **201c** ______

2. **Discharge Operating Dates**
   - a. **Discharge Began Date** If the discharge described below is in operation, give the date (within best estimate) the discharge began. — **202a** ____ ____ YR MO
   - b. **Discharge to Begin Date** If the discharge has never occurred but is planned for some future date, give the date (within best estimate) the discharge will begin. — **202b** ____ ____ YR MO
   - c. **Discharge to End Date** If discharge is scheduled to be discontinued within the next 5 years, give the date (within best estimate) the discharge will end. — **202c** ____ ____ YR MO

3. **Engineering Report Available** Check if an engineering report is available to reviewing agency upon request. (see instructions) — **203** ☐

4. **Discharge Location** Name the political boundaries within which the point of discharge is located.

| | | | | Agency Use |
|---|---|---|---|---|
| State | **204a** | ______________________ | **204d** | ______ |
| County | **204b** | ______________________ | **204e** | ______ |
| (if applicable) City or Town | **204c** | ______________________ | **204f** | ______ |

5. **Discharge Point Description** Discharge is into (check one): (see instructions)

| | | |
|---|---|---|
| Stream (includes ditches, arroyos, and other intermittent watercourses) | **205a** | ☐STR |
| Lake | | ☐LKE |
| Ocean | | ☐OCE |
| Municipal Sanitary Wastewater Transport System | | ☐MTS |
| Municipal Combined Sanitary and Storm Transport System | | ☐MCS |

*This section contains 9 pages.*

DISCHARGE SERIAL NUMBER

__________

| FOR AGENCY USE |
|---|
| |

Municipal Storm Water Transport System ☐ STS

Well (Injection) ☐ WEL

Other ☐ OTH

If 'other' is checked, specify **205b** ____________________

6. **Discharge Point — Lat/Long** Give the precise location of the point of discharge to the nearest second.

Latitude **206a** ____DEG ____MIN ____SEC

Longitude **206b** ____DEG ____MIN ____SEC

7. **Discharge Receiving Water Name** Name the waterway at the point of discharge.(see instructions) **207a** ____________________

If the discharge is through an outfall that extends beyond the shoreline or is below the mean low water line, complete Item 8.

**207b**

For Agency Use

| Major | Minor | Sub |
|---|---|---|
| | | |

**207c**

For Agency Use

| 303e |
|---|
| |

8. **Offshore Discharge**
   a. **Discharge Distance from Shore** **208a** ________feet
   b. **Discharge Depth Below Water Surface** **208b** ________feet

9. **Discharge Type and Occurrence**
   a. **Type of Discharge** Check whether the discharge is continuous or intermittent. (see instructions) **209a** ☐ (con) Continuous ☐ (int) Intermittent
   b. **Discharge Occurrence Days per Week** Enter the average number of days per week (during periods of discharge) this discharge occurs. **209b** __days per week
   c. **Discharge Occurrence —Months** If this discharge normally operates (either intermittently, or continuously) on less than a year-around basis (excluding shutdowns for routine maintenance), check the months during the year when the discharge is operating. (see instructions) **209c**

☐ JAN ☐ FEB ☐ MAR ☐ APR
☐ MAY ☐ JUN ☐ JUL ☐ AUG
☐ SEP ☐ OCT ☐ NOV ☐ DEC

Complete Items 10 and 11 if "intermittent" is checked in Item 9.a. Otherwise, proceed to Item 12.

10. **Intermittent Discharge Quantity** State the average volume per discharge occurrence in thousands of gallons. **210** ________thousand gallons per discharge occurrence.

11. **Intermittent Discharge Duration and Frequency**
    a. **Intermittent Discharge Duration Per Day** State the average number of hours per day the discharge is operating. **211a** ____hours per day
    b. **Intermittent Discharge Frequency** State the average number of discharge occurrences per day during days when discharging. **211b** ____discharge occurrences per day

12. **Maximum Flow Period** Give the time period in which the maximum flow of this discharge occurs. **212** From ____ to ____
    month month

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13. **Activity Description** Give a narrative description of activity producing this discharge.(see instructions)

213a

14. **Activity Causing Discharge** For each SIC Code which describes the activity causing this discharge, supply the type and maximum amount of either the raw material consumed (Item 14a) or the product produced (Item 14b) in the units specified in Table I of the Instruction Booklet. For SIC Codes not listed in Table I, use raw material or production units normally used for measuring production.(see instructions)

a. **Raw Materials**

| | SIC Code | Name | Maximum Amount/Day | Unit (See Table I) | Shared Discharges (Serial Number) |
|---|---|---|---|---|---|
| 214a | (1) | (2) | (3) | (4) | (5) |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

b. **Products**

| | SIC Code | Name | Maximum Amount/Day | Unit (See Table I) | Shared Discharges (Serial Number) |
|---|---|---|---|---|---|
| 214b | (1) | (2) | (3) | (4) | (5) |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

DISCHARGE SERIAL NUMBER

________

| FOR AGENCY USE |
|---|
| ☐☐☐☐☐☐☐☐ |

**15. Waste Abatement**

**a. Waste Abatement Practices**
Describe the waste abatement practices used on this discharge with a brief narrative. (see instructions)

**215a** Narrative: ____________________

**b. Waste Abatement Codes**
Using the codes listed in Table II of the Instruction Booklet, describe the waste abatement processes for this discharge in the order in which they occur if possible.

**215b**

(1) ________, (2) ________, (3) ________,
(4) ________, (5) ________, (6) ________,
(7) ________, (8) ________, (9) ________,
(10) ________, (11) ________, (12) ________,
(13) ________, (14) ________, (15) ________,
(16) ________, (17) ________, (18) ________,
(19) ________, (20) ________, (21) ________,
(22) ________, (23) ________, (24) ________,
(25) ________.

DISCHARGE SERIAL NUMBER

_____________

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**16. Wastewater Characteristics**

**Check the box beside each constituent which is present in the effluent (discharge water). This determination is to be based on actual analysis or best estimate.(see instructions)**

| Parameter<br>216 | Present | Parameter<br>216 | Present |
|---|---|---|---|
| Color<br>00080 | | Copper<br>01042 | |
| Ammonia<br>00610 | | Iron<br>01045 | |
| Organic nitrogen<br>00605 | | Lead<br>01051 | |
| Nitrate<br>00620 | | Magnesium<br>00927 | |
| Nitrite<br>00615 | | Manganese<br>01055 | |
| Phosphorus<br>00665 | | Mercury<br>71900 | |
| Sulfate<br>00945 | | Molybdenum<br>01062 | |
| Sulfide<br>00745 | | Nickel<br>01067 | |
| Sulfite<br>00740 | | Selenium<br>01147 | |
| Bromide<br>71870 | | Silver<br>01077 | |
| Chloride<br>00940 | | Potassium<br>00937 | |
| Cyanide<br>00720 | | Sodium<br>00929 | |
| Fluoride<br>00951 | | Thallium<br>01059 | |
| Aluminum<br>01105 | | Titanium<br>01152 | |
| Antimony<br>01097 | | Tin<br>01102 | |
| Arsenic<br>01002 | | Zinc<br>01092 | |
| Beryllium<br>01012 | | Algicides*<br>74051 | |
| Barium<br>01007 | | Chlorinated organic compounds*<br>74052 | |
| Boron<br>01022 | | Pesticides*<br>74053 | |
| Cadmium<br>01027 | | Oil and grease<br>00550 | |
| Calcium<br>00916 | | Phenols<br>32730 | |
| Cobalt<br>01037 | | Surfactants<br>38260 | |
| Chromium<br>01034 | | Chlorine<br>50060 | |
| Fecal coliform bacteria<br>74055 | | Radioactivity*<br>74050 | |

*Specify substances, compounds and/or elements in Item 26.

Pesticides (insecticides, fungicides, and rodenticides) must be reported in terms of the acceptable common names specified in *Acceptable Common Names and Chemical Names for the Ingredient Statement on Pesticide Labels*, 2nd Edition, Environmental Protection Agency, Washington, D.C. 20250, June 1972, as required by Subsection 162.7(b) of the Regulations for the Enforcement of the Federal Insecticide, Fungicide, and Rodenticide Act.

DISCHARGE SERIAL NUMBER

__________

| FOR AGENCY USE |
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17. **Description of Intake and Discharge**

For each of the parameters listed below, enter in the appropriate box the value or code letter answer called for.(see instructions)

In addition, enter the parameter name and code and all required values for any of the following parameters if they were checked in Item 16; ammonia, cyanide, aluminum, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc, phenols, oil and grease, and chlorine (residual).

| Parameter and Code 217a | Influent | | Effluent | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Untreated Intake Water (Daily Average) (1) | In-Plant Treated Intake Water (Daily Average) (2) | Daily Average (3) | Minimum Value Observed or Expected During Discharge Activity (4) | Maximum Value Observed or Expected During Discharge Activity (5) | Frequency of Analysis (6) | Number of Analyses (7) | Sample Type (8) |
| Flow*<br>Gallons per day<br>00056 | | | | | | | | |
| pH<br>Units<br>00400 | | | X | | | | | |
| Temperature (winter)<br>° F<br>74028 | | | | | | | | |
| Temperature (summer)<br>° F<br>74027 | | | | | | | | |
| Biochemical Oxygen Demand (BOD 5-day)<br>mg/l<br>00310 | | | | | | | | |
| Chemical Oxygen Demand (COD)<br>mg/l<br>00340 | | | | | | | | |
| Total Suspended (nonfilterable) Solids<br>mg/l<br>00530 | | | | | | | | |
| Specific Conductance<br>micromhos/cm at 25° C<br>00095 | | | X | | | | | |
| Settleable Matter (residue)<br>ml/l<br>00545 | | | | | | | | |

*Other discharges sharing intake flow (serial numbers).(see instructions)

EPA Form 7550-23 (7-73)

*FORM APPROVED*
*OMB No. 158–R0100*

| FOR AGENCY USE |
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DISCHARGE SERIAL NUMBER

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**17. (Cont'd.)**

| Parameter and Code 217a | Influent | | Effluent | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Untreated Intake Water (Daily Average) (1) | In-Plant Treated Intake Water (Daily Average) (2) | Daily Average (3) | Minimum Value Observed or Expected During Discharge Activity (4) | Maximum Value Observed or Expected During Discharge Activity (5) | Frequency of Analysis (6) | Number of Analyses (7) | Sample Type (8) |
| | | | | | | | | |
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**18. Plant Controls** Check if the following plant controls are available for this discharge. **218**

Alternate power source for major pumping facility. ☐ APS

Alarm or emergency procedure for power or equipment failure ☐ ALM

Complete item 19 if discharge is from cooling and/or steam water generation and water treatment additives are used.

**19. Water Treatment Additives** If the discharge is treated with any conditioner, inhibitor, or algicide, answer the following:

a. Name of Material(s) **219a** ________

b. Name and address of manufacturer **219b** ________

c. Quantity (pounds added per million gallons of water treated). **219c** ________

DISCHARGE SERIAL NUMBER

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| FOR AGENCY USE |
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d. Chemical composition of these additives (see instructions). **219d** ______

Complete items 20-25 if there is a thermal discharge (e.g., associated with a steam and/or power generation plant, steel mill, petroleum refinery, or any other manufacturing process) and the total discharge flow is 10 million gallons per day or more. (see instructions)

**20. Thermal Discharge Source** Check the appropriate item(s) indicating the source of the discharge. (see instructions) **220**

| | |
|---|---|
| Boiler Blowdown | ☐ BLBD |
| Boiler Chemical Cleaning | ☐ BCCL |
| Ash Pond Overflow | ☐ APOF |
| Boiler Water Treatment — Evaporator Blowdown | ☐ EPBD |
| Oil or Coal Fired Plants — Effluent from Air Pollution Control Devices | ☐ OCFP |
| Condense Cooling Water | ☐ COND |
| Cooling Tower Blowdown | ☐ CTBD |
| Manufacturing Process | ☐ MFPR |
| Other | ☐ OTHR |

**21. Discharge/Receiving Water Temperature Difference**

Give the maximum temperature difference between the discharge and receiving waters for summer and winter operating conditions. (see instructions)

Summer **221a** ______ °F.

Winter **221b** ______ °F.

**22. Discharge Temperature, Rate of Change Per Hour** **222** ______ °F./hour

Give the maximum possible rate of temperature change per hour of discharge under operating conditions. (see instructions)

**23. Water Temperature, Percentile Report (Frequency of Occurrence)**

In the table below, enter the temperature which is exceeded 10% of the year, 5% of the year, 1% of the year and not at all (maximum yearly temperature). (see instructions)

| Frequency of occurrence | | 10% | 5% | 1% | Maximum |
|---|---|---|---|---|---|
| a. Intake Water Temperature (Subject to natural changes) | **223a** | °F | °F | °F | °F |
| b. Discharge Water Temperature | **223b** | °F | °F | °F | °F |

**24. Water Intake Velocity** (see instructions) **224** ______ feet/sec.

**25. Retention Time** Give the length of time, in minutes, from start of water temperature rise to discharge of cooling water. (see instructions) **225** ______ minutes

*FORM APPROVED*
*OMB No. 158–R0100*

DISCHARGE SERIAL NUMBER

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| FOR AGENCY USE |
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**26. Additional Information**

226

| Item | Information |
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## Appendix B

## California Regional Water Quality Control Board
North Coast Region
Order No. 73-134
WASTE DISCHARGE REQUIREMENTS

for

UNION OIL COMPANY OF CALIFORNIA
The Geysers, Sonoma County

The California Regional Water Quality Control Board, North Coast Region, finds that:

1. Union Oil Company of California is currently engaged in geothermal well drilling and exploration, transportation of steam to PG&E power plants, and disposal of waste condensate from PG&E power plants. These operations are or will be conducted on lands located in the following townships: T10N, R8W; T11N, R9W; T11N, R8W; and T12N, R9W, MDB & M. This area is within the Big Sulphur Creek drainage basin and Big Sulphur Creek is a tributary to the Russian River.
2. Wastes produced during the site preparation and during the drilling operations consist of silt, soil, rock cuttings, drilling muds with additives, oils, and associated wastewater. These wastes have traditionally been discharged to waste pits located adjacent to the drilling operations.
3. Due to the severe topography, geology, and weather conditions encountered in the Geysers area, waste pits are subject to failure and have failed and discharged waste to the waters of the State.
4. Waste condensate produced during geothermal power generation is metered and injected into the subsurface strata.
5. The Regional Board adopted Order No. 70-4 Waste Discharge Requirements for Union Oil Company of California on October 29, 1970.
6. The Regional Board adopted an Interim Water Quality Control Plan for the North Coastal Basin on June 14, 1971, and amended the Plan on December 13, 1972 and April 26, 1973.

7. Beneficial uses of waters of Big Sulphur Creek (a Russian River tributary) include:

    a. recreation
    b. preservation and enhancement of fish and wildlife
    c. aesthetic enjoyment
    d. industrial water supply

8. Beneficial uses of the Russian River waters include:

    a. domestic water supply
    b. industrial water supply
    c. agricultural water supply
    d. recreation
    e. preservation and enhancement of fish and wildlife
    f. aesthetic enjoyment

9. The Board has notified the discharger and interested agencies and persons of its intent to prescribe requirements for the proposed discharge.

10. The Board in a public meeting heard and considered all comments pertaining to the discharge.

THEREFORE, IT IS HEREBY ORDERED that Order No. 70-4 adopted October 29, 1970 be rescinded and Union Oil Company of California shall comply with the following:

A. DISCHARGE SPECIFICATIONS

1. The discharge of wastes of any nature to the waters of Big Sulphur Creek or its tributaries is prohibited.

2. The disposal of drilling muds, oils, and associated wastewater in any area not approved and classified by the Regional Board as a disposal site is prohibited.

3. Neither the treatment nor disposal of waste shall cause a nuisance or pollution.

B. PROVISIONS

1. Wastes produced during the drilling site preparation, road construction, and road maintenance shall be placed where it cannot be reasonably expected to be carried into the water of Big Sulphur Creek or its tributaries.

2. Drilling muds, oils, and associated wastewater shall only be disposed of at sites approved by the Regional Board as provided in Chapter 3, Title 23, subchapter 15, of the California Administrative Code, Waste Disposal to Land.

3. All road and exposed earth surfaces shall be protected from erosion.

4. Union Oil Company of California shall comply with the Notification, Monitoring and Reporting Program No. 73-134 and the General Provisions for Monitoring and Reporting as specified by the Executive Officer.

5. Sanitary facilities shall be provided at each drill site.

Certification

I, David C. Joseph, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an order adopted by the California Regional Water Quality Control Board, North Coast Region, on December 19, 1973.

ORIGINAL SIGNED BY

David C. Joseph
Executive Officer

# Appendix C

California Regional Water Quality Control Board
North Coast Region

## NOTIFICATION, MONITORING AND REPORTING PROGRAM NO. 73-134

for

UNION OIL COMPANY OF CALIFORNIA
The Geysers, Sonoma County

## Notification

The discharger shall submit a notice in writing to the Regional Board at least 30 days prior to any construction associated with well drilling or drill site preparation, including road constuction. The notice shall include:

1. proposed construction dates
2. location of the facilities
3. description of the facilities
4. method of construction
5. proposed location of ultimate disposal of drilling muds

In addition, the discharger shall immediate notify the Regional Board of any circulation loss during the construction of a well. The notice shall include:

1. location of the well
2. depth of the well
3. amount of drilling mud lost
4. method of correction

## Monitoring

1. The discharger shall record the volume of waste material removed to an approved disposal area each week and report that data to the Regional Board monthly.

2. Samples of condensate to be disposed of by injection shall be analyzed for the following constituents:

Notification, Monitoring and
Reporting Program No. 73-134

| Constituents | Units | Type of Sample | Sampling and Reporting Frequency |
|---|---|---|---|
| Electrical Conductivity | micromhos. | grab | annually |
| Boron | mg/l | grab | annually |
| Sulfate | mg/l | grab | annually |
| Nitrate | mg/l | grab | annually |
| Volume | bbls/mo. | --- | monthly |

## Reporting

In reporting the monitoring data, the discharger shall arrange the data in tabular form so that the date, the constituents, and the concentrations are readily discernible. The monitoring and any necessary narrative reports shall be transmitted in accordance with specifications of Resolution No. 71-5 adopted by this Board on February 3, 1971.

ORIGINAL SIGNED BY
Ordered by ______________________
David C. Joseph
Executive Officer

December 19, 1973

# CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
# NORTH COAST REGION

## GENERAL MONITORING AND REPORTING PROVISIONS

February 3, 1971

### GENERAL PROVISIONS FOR SAMPLING AND ANALYSIS

Unless otherwise noted, all sampling, sample preservation, and analysis shall be conducted in accordance with the current edition of "Standard Methods for the Examination of Water and Waste Water" or approved by the Executive Officer.

All analyses shall be performed in a laboratory certified to perform such analyses by the California State Department of Public Health or a laboratory approved by the Executive Officer.

All samples shall be representative of the waste discharge under the conditions of peak load.

### GENERAL PROVISIONS FOR REPORTING

For every item where the requirements are not met, the discharger shall submit a statement of the actions undertaken or proposed which will bring the discharge into full compliance with requirements at the earliest time and submit a timetable for correction.

By January 30 of each year, the discharger shall submit an annual report to the Regional Board. The report shall contain both tabular and graphical summaries of the monitoring data obtained during the previous year. In addition, the discharger shall discuss the compliance record and the corrective actions taken or planned which may be needed to bring the discharge into full compliance with the waste discharge requirements.

The discharger shall file a written report within 90 days after the average dry weather flow for any month that equals or exceeds 75 percent of the design capacity of the waste treatment or disposal facilities. The report shall contain a schedule for studies, design, and other steps needed to provide additional capacity or limit the flow below the design capacity prior to the time when the wasteflow rate equals the capacity of the present units.

# APPENDIX D

## Excerpt from 40 CFR Part 6 - New Source NPDES Permits

### 6.910 Guidelines for determining whether to prepare an EIS.

The following guidelines shall be used when performing the environmental review:

(a) General guidelines. (1) When determining the significance of a proposed new source's impact, the responsible official shall consider both its short term and long term effects as well as its primary and secondary effects and beneficial and adverse environmental impacts as defined in 6.924(c).

(2) If EPA is proposing to issue a number of minor, environmentally insignificant new source NPDES permits, during a limited time span and in the same general geographic area the responsible official may determine that the cumulative impact of the issuance of all these permits may have a significant environmental effect.

(3) An EIS will not be required if the responsible official determines that the proposed new source project has been adequately covered in another EIS.

(b) Specific criteria. An EIS will be prepared when: (1) The new source will induce or accelerate significant changes in industrial, commercial, agricultural, or residential land use concentrations or distributions which have the potential for significant environmental effects. Factors that should be considered in determining if these changes are environmentally significant include but are not limited to: the nature and extent of the vacant land subject to increased development pressure as a result of the new source; the increases in population or population density which may be induced and the ramifications of such changes; the nature of land use regulations in the affected area and their potential effects on development and the environment; and the changes in the availability or demand for energy and the resulting environmental consequences.

(2) The new source will directly, or through induced development, have significant adverse effect upon local ambient air quality, local ambient noise levels, surface or groundwater quality or quantity, fish, wildlife, and their natural habitats.

(3) Any major part of the new source will have significant adverse effect on the habitat of threatened or endangered species on the Department of Interior's lists of threatened and endangered species.

(4) The environmental impact of the issuance of a new source NPDES permit is likely to be highly controversial.

(5) The environmental impact of the issuance of a new source NPDES permit will have significant direct and adverse effect on a property listed in or eligible for listing in the National Register of Historic Places.

(6) Any major part of the source will have significant adverse effects on parklands, wetlands, wild and scenic rivers, reservoirs or other important bodies of water, navigation projects, or prime agricultural lands (see 6.920 for additional procedures).

# APPENDIX E

## Excerpt from 40 CFR Part 6 - New Source NPDES Permits

6.924. Content of an environmental impact statement.

(a) Cover sheet. The cover sheet shall indicate the type of EIS (draft or final), the nature of the proposed EPA action, the name of the permit applicant, the responsible EPA office, the date, and the signature of the responsible official. The format is shown in Exhibit 4.

(b) Summary sheet. The summary sheet shall conform to the format prescribed in Appendix I of the August 1, 1973, Council on Environmental Quality's Guidelines (40 CFR 1500). The format is shown in Exhibit 5.

(c) Body of statement. The body of the EIS shall identify, develop, and analyze the pertinent issues included in 6.924(c) (1) through (7) below. Each subsection need not be a separate chapter in the statement. The EIS shall serve as a means for the responsible official and the public to assess the environmental impacts of the proposed issuance of a new source NPDES permit, rather than as a justification for decisions already made. Environmental impact statements should be prepared using a systematic, interdisciplinary approach. Statements should incorporate all relevant analytical disciplines and should provide meaningful and factual data, information, and analyses. The presentation should be simple and concise, yet include all facts necessary to permit independent evaluation and appraisal of the beneficial and adverse environmental effects on the human environment of alternative actions. The amount of detail provided should be commensurate both with the extent and expected impact of the actions, and with the amount of information required at the particular level of decisionmaking. To the extent possible, statements shall not be drafted in a style which requires extensive scientific or technical expertise to comprehend and evaluate the environmental impact of the proposed EPA action.

(1) Background and description of the proposed new source. The EIS shall describe the proposed source, its product or purpose, its location, and its construction and operation time schedule. To prevent piecemeal decision-making, the new source should be described in as broad a context as necessary. The relationship of the proposed new source project to other projects and proposals directly affected by or stemming from the construction and the operation of the new source shall be discussed, including not only other EPA activities, but also those of Governmental and private organizations. Development and population trends in the project area and the assumption on which they are based shall also be included. Maps, photos, and artist's sketches should be incorporated if availalbe when they help depict the environmental setting. If not enclosed, supporting documents should be referenced.

(2) Alternatives available to the proposed new source. The feasible alternatives available to the proposed new source shall be described, developed and objectively weighed against the proposed new source. The analysis should be sufficiently detailed to reveal the EPA's comparative evaluation of the environmental impacts on the human environment, costs, and risks of each feasible alternative. The analysis of alternatives shall include the alternative of not constructing or operating the new source or postponing construction or operation. Feasible design, process, and the site alternatives must be described. This analysis should be written in such a manner that the general public independently can judge the relative desirability of the various alternatives.

(3) Environmental impacts of the proposed new source. This shall be a description of the primary and secondary environmental impacts, both beneficial and adverse, anticipated from the new source. The scope of the description shall include both short and long-term impacts. Emphasis should be given to discussing those factors most directly impacted by the proposed activity.

(i) Primary impacts are those that can be attributed directly to the construction or operation of the new source.

(ii) Secondary impacts are indirect or induced impacts. Construction of a facility such as a large industrial facility may stimulate or induce secondary effects in the form of associated investments and changed patterns of social and economic activities. Particular attention should be paid to potential changes in population patterns or growth. When such changes are significant, their effect on the resource base, including land use, water quality and quantity and air quality should be determined. A discussion of how these impacts conform or conflict with the objectives and specific terms of approved or proposed Federal, State, and local land use plans, policies, and controls for the area should be included.

source permit be issued. The EIS shall describe the kinds and magnitudes of adverse impacts which cannot be reduced in severity, give the remedial and protective measures which can be taken, describe the adverse impacts which can be reduced to an acceptable level, and the mitigative measures which should be taken. These adverse impacts may include water or air pollution, undesirable land use patterns, damage to ecological systems, urban congestion, threats to health or other consequences adverse to the environmental goals set out in section 101(b) of the National Environmental Policy Act.

(5) Relationship between local short term uses of the environment and the maintenance and enhancement of long term beneficial uses. This shall be a description of the extent to which the proposed activity involves trade offs between short term environmental gains at the expense of long term losses, or vice-versa, and the extent to which the proposed action forecloses future options. Special attention should be given to effects which narrow the range of beneficial uses of the environment or pose long term risks to health or safety.

(6) Irreversible and irretrievable commitment of resources which would result if a new source permit were issued. This shall be a description of the extent to which the proposed activity curtails the diversity and range of beneficial uses of the environment. Secondary impacts, such as induced growth in undeveloped areas, may make alternative uses of that land impossible. Also, irreversible damage can result from environmental accidents associated with the new source and this possibility should be evaluated.

(7) A discussion of problems and objections raised by other Federal, State, and local agencies and by interested persons in this review process. Final EIS's (and draft EIS's if appropriate) shall summarize the comments and suggestions made by reviewing organizations and shall describe the disposition of issues raised e.g., changes to the proposed new source to mitigate anticipated impacts or objections. In particular, the EIS shall address any major issues in which the EPA position differs from reviewers' recommendations and objections, giving reasons why specific comments and suggestions could not be adopted. Reviewers' statements should be set forth in a list of "comments" and accompanied by EPA's "responses." In addition, the source of all comments should be clearly identified and copies of the comments (or summaries where a response has been exceptionally long) should be attached to the final EIS.

(d) Documentation. Any books, research reports, field study reports, correspondence and other documents which provided the data base for evaluating the impact of the proposed new source and alternatives discussed in the EIS shall be cited in the body of the EIS and included in a bibliography attached to the EIS.

## APPENDIX F

3200-21
(January 1974)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

# GEOTHERMAL RESOURCES LEASE

_______________________
Serial Number
_______________________
Proper BLM Office
_______________________
Competitive
_______________________
Noncompetitive
_______________________

In consideration of the mutual promises, terms, and conditions contained herein, and the grant made hereby, this lease is entered into by the **UNITED STATES OF AMERICA** (hereinafter called the "Lessor"), acting through the Bureau of Land Management (hereinafter called "the Bureau") of the Department of the Interior (hereinafter called the "Department"), and _______________________ (hereinafter called the "Lessee").

This lease is made pursuant to the Geothermal Steam Act of 1970 (84 Stat. 1566; 30 U.S.C. 1001-1025) (hereinafter called "the Act") to be effective on ____________ , ____________ (hereinafter called the "effective date"). It is subject to all the provisions of the Act and to all the terms, conditions, and requirements (a) of all regulations promulgated by the Secretary of the Interior (hereinafter called "the Secretary") in existence upon the effective date, specifically including, but not limited to, 43 CFR Parts 3000 and 3200 and 30 CFR Parts 270 and 271, and all geothermal resources operational orders (hereinafter called "GRO orders") issued pursuant thereto, all of which are incorporated herein and, by reference, made a part hereof, and (b) of any regulations hereafter issued by the Secretary (except those inconsistent with any specific provisions of this lease other than regulations incorporated herein by reference) all of which shall be, upon their effective date, incorporated herein and, by reference, made a part hereof.

**Sec. 1. GRANT.** The Lessor hereby grants and leases to the Lessee the exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources, hereinafter called "geothermal resources", in or under the following described lands situated within the County of _______________________ , State of _______________ :

| | |
|---|---|
| Public Lands | Acquired Lands |
| T. .R. Meridian | T. .R. Meridian |
| Total Area _______________ | Total Area _______________ |

Containing approximately _______________ acres, hereinafter referred to as the "leased area" or "leased lands", together with:

(a) The non-exclusive right to conduct within the leased area geological and geophysical exploration in accordance with applicable regulations; and

(b) The right to construct or erect and to use, operate and maintain within the leased area, together with ingress and egress thereupon all wells, pumps, pipes, pipelines, buildings, plants, sumps, brine pits, reservoirs, tanks, waterworks, pumping stations, roads, electric power generation plants, transmission lines, industrial facilities, electric, telegraph or telephone lines and such other works and structures and to use so much of the surface of the land as may be necessary or reasonably convenient for the production, utilization and processing of geothermal resources or to the full enjoyment of the rights granted by this lease, subject to compliance with applicable laws and regulations; *Provided that*, although the use of the leased area for an electric power generation plant or transmission facilities or a commercial or industrial facility is authorized hereunder, the location of such facilities and the terms of occupancy therefor shall be under separate instruments issued under any applicable laws and regulations; and

(c) The nonexclusive right to drill potable water wells in accordance with state water laws within the leased area and to use the water produced therefrom for operations on the leased lands free of cost, provided that such drilling and development are conducted in accordance with procedures approved by the Supervisor of the Geological Survey, hereinafter called "Supervisor"; and

(d) The right to convert this lease to a mineral lease under the Mineral Leasing Act of February 25, 1920, as amended and supplemented (30 U.S.C. 181-287) or under the Mineral Leasing Act for Acquired Lands (30 U.S.C. 351-359), whichever is appropriate, if the leasehold is primarily valuable for the production of one or more valuable by-products which are leasable under those statutes, and the lease is incapable of commercial production or utilization of geothermal steam: *Provided that* an application is made therefore prior to the expiration of the lease extension by reason of by-product production as hereinafter provided, and subject to all the terms and conditions of said appropriate Acts. The lessee is also granted the right to locate mineral deposits under the mining laws (30 U.S.C. 21-54), which would consitute by-products if commercial production or utilization of geothermal steam continued, but such a location to be valid must be completed within ninety (90) days after the termination of this lease. Any conversion of this lease to a mineral lease or a mining claim is contingent on the availability of such lands for this purpose at the time of the conversion. If the lands are withdrawn or acquired in aid of a function of any Federal Department or agency, the mineral lease or mining claim shall be subject to such additional terms and conditions as may be prescribed by such Department or agency for the purpose of making operations thereon consistent with the purposes for which these lands are administered; and

(e) The right, without the payment of royalties hereunder, to reinject into the leased lands geothermal resources and condensates to the extent that such resources and condensates are not utilized, but their reinjection is necessary for operations under this lease in the recovering or processing of geothermal resources. If the lessee, pursuant to any approved plan, disposes of the unusable brine and produced waste products into underlying formations, he may do so without the payment of royalties.

**Sec. 2. TERM**

(a) This lease shall be for a primary term of ten (10) years from the effective date and so long thereafter as geothermal steam is produced or utilized in commercial quantities but shall in no event continue for more than forty (40) years after the end of the primary term. However, if at the end of that forty year period geothermal steam is being produced or utilized in commercial quantities, and the leased lands are not needed for other purposes, the Lessee shall have a preferential right to a renewal of this lease for a second forty-year term in accordance with such terms and conditions as the Lessor deems appropriate.

(b) If actual drilling operations are commenced under an approved cooperative or unit plan on the leased lands or on behalf of the leased lands prior to the end of the primary term, and are being diligently prosecuted at the end of the primary term, this lease shall be extended for five (5) years and so long thereafter, but not more than thirty-five (35) years, as geothermal steam is produced or utilized in commercial quantities. If at the end of such extended term geothermal steam is being produced or utilized in commercial quantities, the Lessee shall have a preferential right to a renewal for a second term as in (a) above.

(c) If the Lessor determines at any time after the primary term that this lease is incapable of commercial production and utilization of geothermal steam, but one or more valuable by-products are or can be produced in commercial quantities, this lease shall be extended for so long as such by-products are produced in commercial quantities but for not more than five (5) years from the date of such determination.

### Sec. 3. RENTALS AND ROYALTIES.

(a) *Annual Rental*—For each lease year prior to the commencement of production of geothermal resources in commercial quantities on the leased land, the Lessee shall pay the Lessor on or before the anniversary date of the lease a rental of $____________ for each acre or fraction thereof.

(b) *Escalating Rental*—Beginning with the sixth lease year and for each year thereafter until the lease year beginning on or after the commencement of production of geothermal resources in commercial quantities, the Lessee shall pay on or before the anniversary date of the lease an escalated rental in an amount per acre or fraction thereof equal to the rental per acre for the preceding year and an additional sum of one dollar. If the lease is extended beyond 10 years for reasons other than the commencement of production of geothermal resources in commercial quantities, the rental for the eleventh year and for each lease year thereafter until the lease year beginning on or after the commencement of such production will be the amount of rental for the tenth lease year. If any expenditures are made in any lease year for diligent exploration on the leased lands in excess of the minimum required expenditures for that year, the excess may be credited against any rentals in excess of $____________ per acre due the Lessor for that or any future year.

(c) *Royalty* (1) On or before the last day of the calendar month after the month of commencement of production in commercial quantities of geothermal resources and thereafter on a monthly basis, the Lessee shall pay to the Lessor:

(A) A royalty of ______% on the amount or value of steam, or any other form of heat or other associated energy produced, processed, removed, sold or utilized from this lease or reasonably susceptible to sale or utilization by the Lessee.

(B) A royalty of ______% on the value of any by-product derived from production under this lease, produced, processed, removed, sold or utilized from this lease or reasonably susceptible of sale or utilization by the Lessee, except that as to any by-product which is a mineral named in Section 1 of the Mineral Leasing Act of February 25, 1920, as amended (30 U.S.C. 181), the rate of royalty for such mineral shall be the same as that provided in that statute and the maximum rate of royalty for such mineral shall not exceed the maximum royalty applicable under that statute.

(C) A royalty of ______% on the value of commercially dimineralized water which has been produced from the leased lands, and has been sold or utilized by the Lessee or is reasonably susceptible of sale or utilization by the Lessee. In no event shall the Lesser pay to the Lessor, for the lease year beginning on or after the commencement of production in commercial quantities on the leased lands or any subsequent lease year, a royalty of less than $2 per acre or fraction thereof. If royalty paid on production during the lease year has not satisfied this requirement, the Lessee shall pay the difference on or before the expiration date of the lease year for which it is paid.

(e) *Waiver and Suspension of Rental and Royalties*—Rentals or royalties may be waived, suspended, or reduced pursuant to the applicable regulations on the entire leasehold or any portion thereof in the interest of conservation or for the purpose of encouraging the greatest ultimate recovery of geothermal resources if the Lessor determines that it is necessary to do so in order to promote such development, or because the lease cannot be successfully operated under the terms fixed herein.

(f) *Undivided Fractional Interests*—Where the interest of the Lessor in the geothermal resources underlying any tract or tracts described in Section 2 is an undivided fractional interest, the rentals and royalties payable on account of each such tract shall be in the same proportion to the rentals and royalties provided in this lease as the individual fractional interest of the Lessor in the geothermal resources underlying such tract is to the full fee interest.

(g) *Readjustments*—Rentals and royalties hereunder may be readjusted in accordance with the Act and regulations to rates not in excess of the rates provided therein, and at not less than twenty (20) year intervals beginning thirty-five (35) years after the date geothermal steam is produced from the lease as determined by the Supervisor.

**Sec. 4. PAYMENTS.** It is expressly understood that the Secretary may establish the values and minimum values of geothermal resources for the purpose of computing royalties in accordance with the applicable regulations. Unless otherwise directed by the Secretary, all payments to the Lessor will be made as required by the regulations. If the time for payment falls on a day on which the proper office to receive payment is closed, payment shall be deemed to be made on time if made on the next official working day.

**Sec. 5. BONDS.** The Lessee shall file with the Authorized Officer and shall maintain at all times the bonds required under the regulations to be furnished as a condition to the issuance of this lease or prior to entry on the leased lands in the amounts established by the Lessor and to furnish such additional bonds or security as may be required by the Lessor upon entry on the lands or after operations or production have begun.

### Sec. 6. WELLS.

(a) The Lessee shall drill and produce all wells necessary to protect the leased land from drainage by operations on lands not the property of the Lessor, or other lands of the Lessor leased at a lower royalty rate, or on lands as to which royalties and rentals are paid into different funds from those into which royalties under this lease are paid. However, in lieu of any part of such drilling and production, with the consent of the Supervisor, the Lessee may compensate the Lessor in full each month for the estimated loss of royalty through drainage in the amount determined by said Supervisor.

(b) At his own election, and with the approval of the Supervisor, the Lessee shall drill and produce other wells in conformity with any system of well spacing or production allotments affecting the field or area in which the leased lands are situated, which is authorized by applicable law.

(c) After due notice in writing, the Lessee shall diligently drill and produce such wells as the Supervisor shall require in order that the leased lands may be properly and timely developed and for the production of by-products, including commercially demineralized water for beneficial uses in accordance with applicable state laws. However, the Supervisor may waive or modify the requirements of this subparagraph (c) in the interest of conservation of natural resources or for economic feasibility or other reasons satisfactory to him. If the products or by-products of geothermal production from wells drilled on this lease are susceptible of producing commercially demineralized water for beneficial uses, and a program therefore is not initiated with due diligence, the Lessor may at its option elect to take such products or by-products and the Lessee shall deliver all or any portion thereof to the Lessor at any point in the Lessee's geothermal gathering or disposal system without cost to the Lessee, if the Lessee's activities, under the lease, would not be impaired and such delivery would otherwise be consistent with field and operational requirements. The retention of this option by the Lessor shall in no way relieve the Lessee from the duty of producing commercially demineralized water where required to do so by the Lessor, except when the option is being exercised and then only with respect to wells where it is being exercised, or limit the Lessor's right to take any action under Section 25 to enforce that requirement.

**Sec. 7. INSPECTION.** The Lessee shall keep open at all reasonable times for the inspection of any duly authorized representative of the Lessor the leased lands, and all wells, improvements, machinery, and fixtures thereon and all production reports, maps, records, books, and accounts relative to operations under the lease, and well logs, surveys, or investigations of the leased lands.

**Sec. 8. CONDUCT OF OPERATIONS.** The Lessee shall conduct all operations under this lease in a workmanlike manner and in accordance with all applicable statutes, regulations, and GRO orders, and all other appropriate directives of the Lessor so as to prevent injury to life, health, or property and to avoid the waste of resources of every type, and shall comply with all requirements which are set forth in 43 CFR Group 3200, including, but not limited to, Subpart 3204, or which may be prescribed by the Lessor pursuant to the regulations, and with the special stipulations which are attached to the lease, all of which are specifically incorporated into this lease. A breach of any term of these requirements and stipulations will be a breach of the terms of this lease and subject to all the provisions of this lease with respect to remedies in case of default. Where any stipulation is inconsistent with a regular provision of this lease, the stipulation shall govern.

### Sec. 9. INDEMNIFICATION.

(a) The Lessee shall be liable to the United States for any damage suffered by the United States in any way arising from or connected with the Lessee's activities and operations conducted pursuant to this lease, except where damage is caused by employees of the United States acting within the scope of their authority.

(b) The Lessee shall indemnify and hold harmless the United States from any and all claims arising from or connected with the Lessee's activities and operations under this lease.

(c) In any case where liability without fault is imposed on the Lessee pursuant to this section, and the damages involved were caused by the action of a third party, the rules of subrogation shall apply in accordance with the law of the jurisdiction where the damage occurred.

### Sec. 10. CONTRACTS FOR SALE OR DISPOSAL OF PRODUCTS.

The Lessee shall file with the Supervisor not later than thirty (30) days after the effective date thereof any contract, or evidence of other arrangement for the sale or disposal of geothermal resources.

### Sec. 11. ASSIGNMENT OF LEASE OR INTEREST THEREIN.

Within ninety (90) days from the date of execution thereof, the Lessee shall file for approval by the Authorized Officer of the Bureau (hereinafter called "the Authorized Officer") any instruments of transfer made of this lease or of any interest therein, including assignments of record title and working or other interests.

**Sec. 12. REPORTS AND OTHER INFORMATION.** At such times and in such form as the Lessor may prescribe, the Lessee shall comply with all reporting requirements of the geothermal resources leasing, operating, and unit regulations and shall submit quarterly reports containing the data which it has collected through the monitoring of air, land, and water quality and all other data pertaining to the effect of the environment of operations under the lease. The Lessee shall also comply with such other reporting requirements as may be imposed by the Authorized Officer or the Supervisor. The Lessor may release to the general public any reports, maps, or other information submitted by the Lessee except geologic and geophysical interpretations, maps, or data subject to 30 CFR 270.79 or unless the Lessee shall designate that information as proprietary and the Supervisor or the Authorized Officer shall approve that designation.

**Sec. 13. DILIGENT EXPLORATION.** In the manner required by the regulations, the Lessee shall diligently explore the leased lands for geothermal resources until there is production in commercial quantities applicable to this lease. After the fifth year of the primary term the Lessee shall make at least the minimum expenditures required to qualify the operations on the leased lands as diligent exploration under the regulations.

**Sec. 14. PROTECTION OF THE ENVIRONMENT (LAND, AIR AND WATER) AND IMPROVEMENTS.** The Lessee shall take all mitigating actions required by the Lessor to prevent: (a) soil erosion or damage to crops or other vegetative cover on Federal or non-Federal lands in the vicinity; (b) the pollution of land, air, or water; (c) land subsidence, seismic activity, or noise emissions; (d) damage to aesthetic and recreational values; (e) damage to fish or wildlife or their habitats; (f) damage to or removal of improvements owned by the United States or other parties; or (g) damage to or destruction or loss of fossils, historic or prehistoric ruins, or artifacts. Prior to the termination of bond liability or at any other time when required and to the extend deemed necessary by the Lessor, the Lessee shall reclaim all surface disturbances as required, remove or cover all debris or solid waste, and, so far as possible, repair the offsite and onsite damage caused by his activity or activities incidental thereto, and return access roads or trails and the leased lands to an acceptable condition including the removal of structures, if required. The Supervisor or the Authorized Officer shall prescribe the steps to be taken by Lessee to protect the surface and the environment and for the restoration of the leased lands and other lands affected by operations on the leased lands and improvements thereon, whether or not the improvements are owned by the United States. Timber or mineral materials may be obtained only on terms and conditions imposed by the Authorized Officer.

**Sec. 15. WASTE.** The Lessee shall use all reasonable precautions to prevent waste of natural resources and energy, including geothermal resources, or of any minerals, and to prevent the communication of water or brine zones with any oil, gas, fresh water, or other gas or water bearing formations or zones which would threaten destruction or damage to such deposits. The Lessee shall monitor noise and air and water quality conditions in accordance with any orders of the Supervisor.

**Sec. 16. MEASUREMENTS.** The Lessee shall gauge or otherwise measure all production, sales, or utilization of geothermal resources and shall record the same accurately in records as required by the Supervisor. The records shall be kept and preserved by the Lessee for a period of five (5) years.

**Sec. 17. RESERVATIONS TO LESSOR.** All rights in the leased area not granted to the Lessee by this lease are hereby reserved to the Lessor. Without limiting the generality of the foregoing such reserved rights include:

(a) *Disposal*–The right to sell or otherwise dispose of the surface of the leased lands or any resource in the leased lands under existing laws, or laws hereafter enacted, subject to the Lessee under this lease;

(b) *Rights-of-way*–The right to authorize geological and geophysical explorations on the leased lands which do not interfere with or endanger actual operations under this lease, and the right to grant such easements or rights-of-way for joint or several use upon, through or in the leased area for steam lines and other public or private purposes which do not interfere with or endanger actual operations or facilities constructed under this lease;

(c) *Mineral Rights*–The ownership of and the right to extract oil, hydrocarbon gas, and helium from all geothermal steam and associated geothermal resources produced from the leased lands;

(d) *Casing*–The right to acquire the well and casing at the fair market value of the casing where the Lessee finds only potable water, and such water is not required in lease operations or any well drilled for the production of geothermal resources; and

(e) *Measurements*–The right to measure geothermal resources and to sample any production thereof.

**Sec. 18. ANTIQUITIES AND OBJECTS OF HISTORIC VALUE.** The Lessee shall immediately bring to the attention of the Authorized Officer any and all antiquities or other objects of historic or scientific interest, including but not limited to historic or prehistoric ruins, fossils, or artifacts discovered as a result of operations under this lease, and shall leave such discoveries intact. Failure to comply with any of the terms and conditions imposed by the Authorized Officer with regard to the preservation of antiquities may constitute a violation of the Antiquities Act (16 U.S.C. 431-433). Prior to operations, the Lessee shall furnish to the Authorized Officer a certified statement that either no archaeological values exist or that they may exist on the leased lands to the best of the Lessee's knowledge and belief and that they might be impaired by geothermal operations. If the Lessee furnishes a statement that archaeological values may exist where the land is to be disturbed or occupied, the Lessee will engage a qualified archaeologist, acceptable to the Authorized Officer, to survey and salvage, in advance of any operations, such archaeological values on the lands involved. The responsibility for the cost for the certificate, survey, and salvage will be borne by the Lessee, and such salvaged property shall remain the property of the United States or the surface owner.

**Sec. 19. DIRECTIONAL DRILLING.** A directional well drilled under the leased area from a surface location on nearby land not covered by the lease shall be deemed to have the same effect for all purposes of this lease as a well drilled from a surface location on the leased area. In such circumstances, drilling shall be considered to have been commenced on the leased area when drilling is commenced on the nearby land for the purpose of directional drilling under the leased area, and production of geothermal resources from the leased area through any directional well located on nearby land, or drilling or reworking of any such directional well shall be considered production or drilling or reworking operations (as the case may be) on the leased area for all purposes of this lease. Nothing contained in this section shall be construed as granting to the Lessee any rights in any land outside the leased area.

**Sec. 20. OVERRIDING ROYALITIES.** The Lessee shall not create overriding royalties of less than one-quarter (1/4) of one percent of the value of output nor in excess of 50 percent of the rate of royalty due to the United States specified in Section 3 of this lease except as otherwise authorized by the regulations. The Lessee expressly agrees that the creation of any overriding royalty which does not provide for a prorated reduction of all overriding royalties so that the aggregate rate of royalties does not exceed the maximum rate permissible under this section, or the failure to suspend an overriding royalty during any period when the royalties due to the United States have been suspended pursuant to the terms of this lease, shall constitute a violation of the lease terms.

**Sec. 21. READJUSTMENT OF TERMS AND CONDITIONS.** The terms and conditions of this lease other than those related to rentals and royalties may be readjusted in accordance with the Act at not less than ten-year intervals beginning ten (10) years after the date geothermal steam is produced from the leased premises as determined by the Supervisor.

**Sec. 22. COOPERATIVE OR UNIT PLAN.** The Lessee agrees that it will on its own, or at the request of the Lessor where it is determined to be necessary for the conservation of the resource or to prevent the waste of the resource, subscribe to and operate under any reasonable cooperative or unit plan for the development and operation of the area, field, or pool, or part thereof embracing the lands subject to this lease as the Secretary may determine to be practicable and necessary or advisable in the interest of conservation. In the event the leased lands are included within a unit, the terms of this lease shall be deemed to be modified to conform to such unit agreement. Where any provision of a cooperative or unit plan of development which has been approved by the Secretary, and which by its terms affects the leased area or any part thereof, is inconsistent with a provision of this lease, the provisions of such cooperative or unit plan shall govern.

**Sec. 23. RELINQUISHMENT OF LEASE.** The Lessee may relinquish this entire lease or any officially designated subdivision of the leased area in accordance with the regulations by filing in the proper Bureau office a written relinquishment, in triplicate, which shall be effective as of the date of filing. No relinquishment of this lease or of any portion of the leased area shall relieve the Lessee or his surety from any liability for breach of any obligation of this lease, including the obligations to make payment of all accrued rentals and royalties and to place all wells in the leased lands to be relinquished in condition for suspension or abandonment, and to protect or restore substantially the surface or subsurface resources in a manner satisfactory to the Lessor.

**Sec. 24. REMOVAL OF PROPERTY ON TERMINATION OR EXPIRATION OF LEASE.**

(a) Upon the termination or expiration of this lease in whole or in part, or the relinquishment of the lease in whole or in part, as herein provided, the Lessee shall within a period of ninety (90) days (or such longer period as the Supervisor may authorize because of adverse climatic conditions) thereafter remove from the leased lands, no longer subject to the lease all structures, machinery, equipment, tools and materials in accordance with applicable regulations and orders of the Supervisor. However, the Lessee shall, for a period of not more than six (6) months, continue to maintain any such property needed on the relinquished area, as determined by the Supervisor, for producing wells or for drilling or producing geothermal resources on other leases.

(b) Any structures, machinery, equipment, tools, appliances, and materials, subject to removal by the Lessee as provided above, which are allowed to remain on the leased lands shall become the property of the Lessee on expiration of the 90-day period or any extension of that period which may be granted by the Supervisor. If the Supervisor directs the Lessee to remove such property, the Lessee shall do so at his own expense, or if he fails to do so within a reasonable period, the Lessor may do so at the Lessee's expense.

**Sec. 25. REMEDIES IN CASE OF DEFAULT.**

(a) Whenever the Lessee fails to comply with any of the provisions of the Act, or of this lease, or of the regulations issued under the Act, or of any order issued pursuant to those regulations and that default shall continue for a period of thirty (3) days after service of notice by the Lessor, the Lessor may (1) suspend operations until the requested action is taken to correct the noncompliance, or (2) cancel the lease in accordance with Section 12 of the Act (30 U.S.C. 1011). However, the 30-day notice provision applicable to this lease under Section 12 of the Act shall also apply as a prerequisite to the institution of any legal proceedings by the Lessor to cancel this lease while it is in a producing status. Nothing in this subsection shall be construed to apply to, or require any notice with respect to any legal action instituted by the Lessor other than an action to cancel the lease pursuant to Section 12 of the Act.

(b) Whenever the Lessee fails to comply with any of the provisions of the Act, or of this lease, or the regulations, or of any GRO, or other orders, and immediate action is required, the Lessor without waiting for action by the Lessee may enter on the leased lands and take such measures as he may deem necessary to correct the failure, including a suspension of operations or production all at the expense of the Lessee. The Lessor may also exercise any legal or equitable remedy or remedies which it may have.

(c) A waiver of any particular violation of the provisions of the Act, or of this lease, or of any regulations promulgated by the Secretary under the Act, shall not prevent the cancellation of this lease or the exercise of any other remedy or remedies under paragraphs (a) and (b) of this section by reason of any other such violation, or for the same violation occuring at any other time.

(d) Nothing herein shall limit or affect the Lessee's right to a hearing and appeal as provided in Section 12 of the Act and in the regulations promulgated thereunder.

(e) Upon cancellation, the Lessee shall remove all property in accordance with Section 24 hereof, and shall restore the leased lands in a manner acceptable to the Lessor or as may be otherwise required by the Lessor.

**Sec. 26. HEIRS AND SUCCESSORS IN INTEREST.** Each obligation hereunder shall extend to and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns, of the respective parties hereto.

**Sec. 27. UNLAWFUL INTEREST.** No member of, or Delegate to Congress, or Resident Commissioner, after his election or appointment, either before or after he has qualified, and during his continuance in office, and no officer, agent, or employee of the Department shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom; and the provisions of Section 3741 of the Revised Statutes (41 U.S.C. Sec. 22), as amended, and Sections 431, 432, and 433 of Title 18 of the United States Code, relating to contracts made or entered into, or accepted by or on behalf of the United States, form a part of this lease so far as the same may be applicable.

**Sec. 28. EQUAL OPPORTUNITY CLAUSE.** The Lessee agrees that, during the performance of this lease:

(1) The Lessee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Lessor setting forth the provisions of this Equal Opportunity clause.

(2) The Lessee will, in all solicitations or advertisements for employees placed by or on behalf of the Lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The Lessee will send to each labor union or representative of workers with which Lessee has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Lessor, advising the labor union or workers' representative of the Lessee's commitments under this Equal Opportunity clause, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The Lessee will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, as amended, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the Secretary of the Interior and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the Lessee's noncompliance with the Equal Opportunity clause of this lease or with any of said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the Lessee may be declared ineligible for further Federal Government contracts or leases in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, as amended, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, as amended, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Lessee will include the provisions of Paragraphs (1) through (7) of this Section (28) in every contract, subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, as amended, so that such provisions will be binding upon each contractor, subcontractor, or subcontract, or purchase order as the Secretary may direct as a means subcontract or purchase order as the Secretary may direct as a means of enforcing such provisions including sanctions for noncompliance; *provided, however,* that in the event the Lessee becomes involved in, or is threatened with, litigation with a contractor, subcontractor, or vendor as a result of such direction by the Secretary, the Lessee may request the Lessor to enter into such litigation to protect the interests of the Lessor.

**Sec. 29. CERTIFICATION OF NONSEGREGATED FACILITIES.** By entering into this lease, the Lessee certifies that Lessee does not and will not maintain or provide for Lessee's employees any segregated facilities at any of Lessee's establishments, and that Lessee does not and will not permit Lessee's employees to perform their services at any location, under Lessee's control, where segregated facilities are maintained. The Lessee agrees that a breach of this certification is a violation of the Equal Opportunity clause of this lease. As used in this certification, the term "segregated facilities" means, but is not limited to, any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise. Lessee further agrees that (except where Lessee has obtained identical certifications from proposed contractors and subcontractors for specific time periods) Lessee will obtain identical certifications from proposed contractors and subcontractors prior to the award of contracts or subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause; that Lessee will retain such certifications in Lessee's files; and that Lessee will forward the following notice to such proposed contractors and subcontractors (except where the proposed contractor or subcontractor has submitted identical certifications for specific time periods): Lessee will notify prospective contractors and subcontractors of requirement for certification of nonsegregated facilities. A Certification of Nonsegregated Facilities, as required by the May 9, 1967 Order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a contract or subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each contract and subcontract or for all contracts and subcontracts during a period (i.e., quarterly, semiannually, or annually).

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**Sec. 30. SPECIAL STIPULATIONS.**

In witness whereof the parties have executed this lease.

THE UNITED STATES OF AMERICA

By ______________________________

(Authorized Officer)

______________________________

(Signature of Lessee)

______________________________

(Signature of Lessee)

______________________________

(Title)

______________________________

(Date)

______________________________

(Date)

# APPENDIX G

| | |
|---|---|
| UNITED STATES<br>DEPARTMENT OF THE INTERIOR<br>BUREAU OF LAND MANAGEMENT<br>**NOTICE OF INTENT TO CONDUCT GEOTHERMAL RESOURCE EXPLORATION OPERATIONS** | **Notice Number** |

| | |
|---|---|
| **Applicant(s)** | **Address** *(include zip code)* |
| **Operator** | **Address** *(include zip code)* |
| **Contractor(s)** | **Address** *(include zip code)* |

**hereby apply for authorization to conduct exploration operations pursuant to the provisions of 43 CFR 3209 now or hereafter in force across and upon the following-described lands** *(give description of lands by township, attach map or maps showing lands to be entered or affected)*

**Type of operations to be conducted** *(give brief description)*

**Exploration operations will be conducted during the period** *(date)* **from**      **to**

**Attached** ☐ **$**    **Surety bond** ☐ **Rider to Nationwide bond** ☐ **Rider to Statewide bond** ☐ **Bond to be furnished**

**Upon completion of exploration operations the undersigned agrees to notify the Authorized Officer that authorized exploration operations have been completed in conformance with the general and special terms and stipulations of the notice.**

**The undersigned hereby agrees (1) that he will not enter upon the described land until he has been informed in writing whether there are special stipulations applicable to his Notice of Intent, as to either time or method of operation or otherwise, and, if there are such stipulations, what those stipulations are, (2) that he will comply with those special stipulations, if any; and (3) that he will not enter upon the described lands until his entry has been approved by the Authorized Officer.**

**The undersigned agrees to be bound by the terms and conditions of this notice to conduct exploration operations when approved by the Authorized Officer.**

**The undersigned agrees that the filing of this** *Notice* **under the regulations (43 CFR Subpart 3209) does not vest or confer any preference right to a geothermal resources lease.**

**The undersigned agrees further that all exploration operations shall be conducted pursuant to the following terms and conditions:**

1. **Exploration operations shall be conducted in compliance with all Federal, State, and local laws, ordinances, or regulations which are applicable to the area of operations including, but not limited to, those pertaining to fire, sanitation, conservation, water pollution, fish, and game. All operations hereunder shall be conducted in a prudent manner.**
2. **Due care shall be exercised in protecting the described lands from damage. All necessary precautions shall be taken to avoid any damage other than normal wear and tear to improvements on the land including, but not limited to, gates, bridges, roads, culverts, cattle guards, fences, dams, dikes, vegetative cover, improvements, stock watering, and other facilities.**
3. **All drill holes shall be capped when not in use and appropriate procedures shall be taken to protect against hazards in order to protect the lives, safety, or property of other persons or of wildlife and livestock.**
4. **All vehicles shall be operated at a reasonable rate of speed and, in the operation of vehicles, due care shall be taken to safequard livestock and wildlife in the vicinity of operations. Existing roads and trails shall be used wherever possible. If new roads and trails are to be constructed, the Authorized Officer must be consulted prior to construction as to location and specifications. Reclamation and/or reseeding of new roads and trails shall be made as requested by the Authorized Officer.**
5. **Upon expiration, conclusion, or abandonment of operations conducted pursuant to this** *Notice,* **all equipment shall be removed from the land, and the land shall be restored as nearly as practicable to its original condition by such measures as the Authorized Officer may specify. All geophysical holes shall be safely plugged. The Authorized Officer shall be furnished a** *Notice of Completion of Geothermal Resource Exploration Operations* **(Form 3200-3) immediately upon cessation of all such operations and shall be further informed of the completion of reclamation work as soon as possible.**
6. **Location and depth of water sands encountered shall be disclosed to the Authorized Officer.**

*(Continued on reverse)*

**Form 3200-9 (December 1973)**

7. Operator shall contact the Authorized Officer, prior to actual entry upon the land in order to be appraised of practices which shall be followed or avoided in the conduct of exploration operations pursuant to the terms of this *Notice* and applicable regulations. Operator will conduct no operations on the land unless the attached bond is in good standing.

8. Due care shall be exercised to avoid scarring or removal of ground vegetative cover.

9. All operations shall be conducted in such a manner to avoid (a) blockage of any drainage systems; (b) changing the character, or causing the pollution or siltation of rivers, streams, lakes, ponds, waterholes, seeps, and marshes; and (c) damaging fish and wildlife resources or habitat. Cuts or fills causing any of the above-mentioned problems will be repaired immediately in accordance with specifications of the Authorized Officer.

10. Vegetation shall not be disturbed within 300 feet of waters designated by the Authorized Officer, except at approved stream crossings.

11. Surface damage which induces soil movement and/or water pollution shall be subject to corrective action as required by the Authorized Officer.

12. Trails and campsites shall be kept clean. All garbage and foreign debris shall be eliminated as required by the Authorized Officer.

13. Operator shall protect all survey monuments, witness corners, reference monuments, and bearing trees against destruction, obliteration, or damage. He shall, at his expense reestablish damaged, destroyed, or obliterated monuments and corners, using a licensed surveyor, in accordance with Federal survey procedures. A record of the reestablishment shall be submitted to the Authorized Officer.

14. Operator shall make every reasonable effort to prevent, control, or suppress any fires started by the operator, and to report, as soon as possible, to the Authorized Officer location and size of fires, and assistance needed to suppress such fires. Operator shall inform the Authorized Officer as soon as possible of all fires, regardless of location, noted, or suppressed by independent action.

15. No work shall be done within one-half mile of a developed recreation site without specific written authority from the Authorized Officer. Any travel within one-half mile of a recreation site shall be over existing roads or trails.

16. Use of explosives within one-half mile of designated waters is prohibited unless approved, in writing, by the Authorized Officer.

17. If operations conducted under the provisions of this *Notice* causes any damage to the surface of the national resource lands, such as, but not limited to, soil erosion, pollution of water, injury or destruction of livestock or wildlife, or littering, operator shall, within 48 hours, file with the Authorized Officer a map showing exact location of such damage and a written report containing operator's plans for correcting or minimizing damage, if possible.

18. Violation of, or failure to comply with any of these terms and conditions shall result in immediate shutdown of field operations until deficiency is corrected. Failure to correct deficiency within the time period allowed by the Authorized Officer shall result in forfeiture of bond.

19. The Bureau of Land Management reserves the right to close any area to operators in periods of fire danger or when irreparable damage to natural resources is imminent.

20. Contractor shall be liable for assuring compliance with all terms and conditions of this *Notice* and all actions of his designated operator, agents, and employees.

21. Where continuation of the operation will result in irreparable damage to the land and other natural resources this *Notice* will be immediately cancelled by the Authorized Officer.

**22. Special Stipulations:**

(Signature of Applicant) (Date) (Signature of Operator) (Date)

**We hereby agree to the special stipulations added and made a part of this *Notice* to conduct exploration operations.**

(Signature of Holder of Notice) (Date) (Signature of Operator) (Date)

**I hereby approve this *Notice* to conduct exploration operations.**

(Signature of Authorized Officer) (Title) (Date)

GPO 881-317

# APPENDIX H

## Subsidence Requirements of State of Wyoming Geothermal Lease

SECTION 11. SUBSIDENCE. The Board reserves and retains the right, upon receipt of any evidence of subsidence of the surface of either the leased or adjacent lands, to determine that any or all further operations under this lease would or might aggravate or cause subsidence to the impairment of, or interference with, the developed areas adjacent to the leased lands or damage to other properties. In the event of such determination, the Board may notify the Lessee, in writing, to suspend in the manner and to the extent specified in said notice, all or any part of Lessee's operations under this lease within thirty (30) days of said notice, and Lessee agrees to suspend said operations within said time in the manner and to the extent so specified. The Lessee must also notify the Board immediately of any evidence of subsidence.

Exercise of the foregoing right by the Board is subject to the following PROVISOS:

(a) Such determination may be made by the Board at any time during the effective term of this lease but only at a meeting of said Board after written notice to Lessee that the Board has received evidence of such subsidence and proposes to determine whether any or all further operations under this lease would or might cause or aggravate subsidence to the impairment of, or interference with, the developed area or damage to other properties adjacent to the leased lands. At any such meeting Lessee may present facts and arguments relevant to such determination.

(b) At said meeting, the Board shall, to the best of its ability and to the extent permitted by law, make available to Lessee for study any and all written and graphic information and opinions theretofore recieved or prepared by or for the Board relative to susidence of the surface of the leased and adjacent lands.

(c) Operations under this lease suspended pursuant to this Section may be resumed by lessee, in whole or in part, only in the manner and to the extent provided and subject to conditions contained in a program, agreed to by both the Board and Lessee, designed to alleviate or prevent further subsidence.

(d) Notwithstanding any agreement by the State to any such program, the Board may, upon receipt of evidence of further such subsidence occurring subsequent to the resumption of operations under such program, notify Lessee to again suspend operations in accordance with the provisions of this Section, and Lessee agrees to so suspend operations.

During any such period of suspension in whole or in part pursuant to this Section, the rental, minimum royalty, drilling, offset, and production obligations of Lessee shall likewise be suspended in whole or in part to the extent and only to the extent that such rental, minimum royalty, drilling, offset, and production obligations are rendered impracticable or unreasonable as a result of the notice to supend issued by the State pursuant to this Section.

The rights reserved and retained by the Board under this Section shall be exercisable to the extent and only to the extent that such exercise is permitted by law at the time of such exercise.

APPENDIX I

## CALIFORNIA ENVIRONMENTAL QUALITY ACT OF 1970 AS AMENDED*

(Public Resources Code Secs. 21000 et seq.)

21000. The Legislature finds and declares as follows:

(a) The maintenance of a quality environment for the people of this state now and in the future is a matter of statewide concern.

(b) It is necessary to provide a high-quality environment that at all times is healthful and pleasing to the senses and intellect of man.

(c) There is a need to understand the relationship between the maintenance of high-quality ecological systems and the general welfare of the people of the state, including their enjoyment of the natural resources of the state.

(d) The capacity of the environment is limited, and it is the intent of the Legislature that the government of the state take immediate steps to identify any critical thresholds for the health and safety of the people of the state and take all coordinated actions necessary to prevent such thresholds being reached.

(e) Every citizen has a responsibility to contribute to the preservation and enhancement of the environment.

(f) The interrelationship of policies and practices in the management of natural resources and waste disposal requires systematic and concerted efforts by public and private interests to enhance environmental quality and to control environmental pollution.

(g) It is the intent of the Legislature that all agencies of the state government which regulate activities of private individuals, corporations, and public agencies which are found to affect the quality of the environment, shall regulate such activities so that major consideration is given to preventing environmental damage.

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*As amended by AB 889 (Chap. 1154), 1972; AB 2338 (Chap. 56), 1974.

21001. The Legislature further finds and declares that it is the policy of the state to:

(a) Develop and maintain a high-quality environment now and in the future, and take all action necessary to protect, rehabilitate, and enhance the environmental quality of the state.

(b) Take all action necessary to provide the people of this state with clean air and water, enjoyment of aesthetic, natural, scenic, and historic environmental qualities, and freedom from excessive noise.

(c) Prevent the elimination of fish or wildlife species due to man's activities, insure that fish and wildlife populations do not drop below self-perpetuating levels, and preserve for future generations representations of all plant and animal communities and examples of the major periods of California history.

(d) Ensure that the long-term protection of the environment shall be the guiding criterion in public decisions.

(e) Create and maintain conditions under which man and nature can exist in productive harmony to fulfill the social and economic requirements of present and future generations.

(f) Require governmental agencies at all levels to develop standards and procedures necessary to protect environmental quality.

(g) Require governmental agencies at all levels to consider qualitative factors as well as economic and technical factors and long-term benefits and costs, in addition to short-term benefits and costs and to consider alternatives to proposed actions affecting the environment.

21050. This division shall be known and may be cited as the Environmental Quality Act of 1970.

21060. Unless the context otherwise requires, the definitions in this chapter govern the construction of this division.

21060.5. "Environment" means the physical conditions which exist within the area which will be affected by a proposed project, including land, air, water, minerals, flora, fauna, noise, objects of historic or aesthetic significance.

21061. "Environmental impact report" means a detailed statement setting forth the matters specified in Section 21100. It includes any comments on an environmental impact report which are obtained pursuant to Section 21104 or 21153, or which are required to be obtained pursuant to this division.

An environmental impact report is an informational document which, when its preparation is required by this division, shall be considered by every public agency prior to its approval or disapproval of a project. The purpose of an environmental impact report is to provide public agencies with detailed information about the effect which a proposed project is likely to have on the environment; to list ways in which any adverse effects of such a project might be minimized and to suggest alternatives to such a project.

21062. "Local agency" means any public agency other than a state agency, board, or commission. For purposes of this division, a redevelopment agency is a local agency, and not a state agency, board or commission.

21063. "Public agency" includes any state agency, board, or commission, any county, city and county, city, regional agency, public district, redevelopment agency, or other political subdivision.

21065. "Project" means the following:

(a) Activities directly undertaken by any public agency.

(b) Activities undertaken by a person which are supported in whole or in part through contracts, grants, subsidies, loans, or other forms of assistance from one or more public agencies.

(c) Activities involving the issuance to a person of a lease, permit, license, certificate, or other entitlement for use by one or more public agencies.

21066. "Person" includes any person, firm, association, organization, partnership, business, trust, corporation, company, district, county, city, town, the state, and any of the agencies and political subdivisions of such entities.

21067. "Lead agency" means the public agency which has the principal responsibility for carrying out or approving a project which may have a significant effect upon the environment.

21080. (a) Except as otherwise provided in this division, this division shall apply to discretionary projects proposed to be carried out or approved by public agencies, including, but not limited to, the enactment and amendment of zoning ordinances, the issuance of zoning variances, the issuance of conditional use permits and the approval of tentative subdivision maps (except where such a project is exempt from the preparation of an environmental impact report pursuant to Section 21166).

(b) This division shall not apply to ministerial projects proposed to be carried out or approved by public agencies.

21082. All public agencies shall adopt by ordinance, resolution, rule or regulation, objectives, criteria and procedures for the evaluation of projects and the preparation of environmental impact reports pursuant to this division. The objectives, criteria and procedures shall be consistent with the provisions of this division and with the guidelines adopted by the Secretary of the Resources Agency pursuant to Section 21083. Such objectives, criteria and procedures shall be adopted by each public agency no later than 60 days after the Secretary of the Resources Agency has adopted guidelines pursuant to Section 21083.

21083. The Office of Planning and Research shall prepare and develop proposed guidelines for the implementation of this division by public agencies. Such guidelines shall include objectives and criteria for the orderly evaluation of projects and the preparation of environmental impact reports in a manner consistent with this division.

Such guidelines shall specifically include criteria for public agencies to follow in determining whether or not a proposed project may have a "significant effect on the environment." Such criteria shall require a finding of "significant effect on the environment" if any of the following conditions exist:

(a) A proposed project has the potential to degrade the quality of the environment, curtail the range of the environment, or to achieve short-term, to the disadvantage of long-term, environmental goals;

(b) The possible effects of a project are individually limited but cumulatively considerable;

(c) The environmental effects of a project will cause substantial adverse effects on human beings, either directly or indirectly.

Such guidelines shall also include procedures for determining the lead agency pursuant to the provisions of Section 21165.

The Office of Planning and Research shall develop and prepare such proposed guidelines as soon as possible and shall transmit them immediately to the Secretary of the Resources Agency. No later than 60 days after the effective date of this section the Secretary of the Resources Agency shall certify and adopt such guidelines pursuant to Chapter 4.5 (commencing with Section 11371) of part 1, Division 3, Title 2 of the Government Code, which shall become effective upon the filing thereof, provided that such guidelines shall not be adopted without compliance with Sections 11423, 11424, and 11425 of the Government Code.

21083.5. The guidelines prepared and adopted pursuant to Section 21083 may provide that when an environmental impact statement has been, or will be, prepared for the same project pursuant to the requirements of the National Environmental Policy Act of 1969 and implementing regulations thereto, all or any part of such statement may be submitted in lieu of all or any part of an environmental impact report required by this division, provided that such statement, or the part thereof so used, shall comply with the requirements of this division and the guidelines adopted pursuant thereto.

21084. The guidelines prepared and adopted pursuant to Section 21083 shall include a list of classes of projects which have been determined not to have a significant effect on the environment and which shall be exempt from the provisions of this division. In adopting the guidelines, the Secretary of the Resources Agency shall make a finding that the list or classification of projects referred to in this section do not have a significant effect on the environment.

21085. All classes of projects designated pursuant to Section 21084, together with emergency repairs to public service facilities necessary to maintain service, shall be exempt from the provisions of this division.

21086. A public agency may, at any time, request the addition or deletion of a class of projects, to the list designated pursuant to Section 21084. Such a request shall be made in writing to the Office of Planning and Research and shall include information supporting the public agency's position that such class of projects does, or does not, have a significant effect on the environment.

The Office of Planning and Research shall review each such request and, as soon as possible, shall submit its recommendation to the Secretary of the Resources Agency. Following the receipt of such recommendation, the Secretary of the Resources Agency may add or delete the class of projects to the list of classes of projects designated pursuant to Section 21084 which are exempt from the requirements of this division.

The addition or deletion of a class of projects, as provided in this section, to the list specified in Section 21084 shall constitute an amendment to the guidelines adopted pursuant to Section 21083 and shall be adopted in the manner prescribed in Sections 21083, 21084, and 21087.

21087. The Office of Planning and Research shall periodically review the guidelines adopted pursuant to Section 21083 and shall recommend proposed changes or amendments to the Secretary of the Resources Agency. Changes or amendments to the guidelines shall be adopted by the Secretary of the Resources Agency in the same manner as provided in Section 21083 for the adoption of the original guidelines.

21088. The Secretary of the Resources Agency shall provide for the timely distribution to all public agencies of the guidelines and any amendments or changes thereto. In addition, the Secretary of the Resources Agency may provide for publication of a bulletin to provide public notice of the guidelines, or any amendments or changes thereto, and of the completion of environmental impact reports prepared in compliance with this division.

21089. A public agency may charge and collect a reasonable fee from any person proposing a project subject to the provisions of this division in order to recover the estimated costs incurred by the public agency in preparing an environmental impact report for such project.

21090. For all purposes of this division all public and private activities or undertakings pursuant to or in furtherance of a redevelopment plan shall be deemed a single project.

21100. All state agencies, boards, and commissions shall prepare, or cause to be prepared by contract, and certify the completion of an environmental impact report on any project they propose to carry out or approve which may have a significant effect on the environment. Such a report shall include a detailed statement setting forth the following:

(a) The environmental impact of the proposed action.

(b) Any adverse environmental effects which cannot be avoided if the proposal is implemented.

(c) Mitigation measures proposed to minimize the impact.

(d) Alternatives to the proposed action.

(e) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity.

(f) Any irreversible environmental changes which would be involved in the proposed action should it be implemented.

(g) The growth-inducing impact of the proposed action.

21101. In regard to any proposed federal project in this state which may have a significant effect on the environment and on which the state officially comments, the state officials responsible for such comments shall include in their report a detailed statement setting forth the matters specified in Section 21100 prior to transmitting the comments of the state to the federal government. No report shall be transmitted to the federal government unless it includes such a detailed statement as to the matters specified in Section 21100.

21102. No state agency, board, or commission shall request funds, nor shall any state agency, board, or commission which authorizes expenditures of funds, other than funds appropriated in the Budget Act, authorize funds for expenditure for any project, other than a project involving only feasibility or planning studies for possible future actions which the agency, board, or commission has not approved, adopted or funded, which may have a significant effect on the environment unless such request or authorization is accompanied by an environmental impact report.

Feasibility and planning studies exempted by this section from the preparation of an environmental impact report shall nevertheless include consideration of environmental factors.

21104. Prior to completing an environmental impact report, the responsible state agency shall consult with, and obtain comments from, any public agency which has jurisdiction by law with respect to the project, and may consult with any person who has special expertise with respect to any environmental impact involved.

21105. The responsible state agency shall include the environmental impact report as a part of the regular project report used in the existing review and budgetary process. It shall be available to the Legislature. It shall also be available for inspection by the general public who may secure a copy thereof by paying for the actual cost of such a copy. It shall be filed by the responsible state agency with the appropriate local planning agency of any city, county, or city and county which will be affected by the project.

21106. All state agencies, boards, and commissions shall request in their budgets the funds necessary to protect the environment in relation to problems caused by their activities.

21108. [Amended by AB 2338, Chap. 56, 1974.] (a) Whenever a state agency, board, or commission approves or determines to carry out a project which is subject to the provisions of this division, it shall file notice of such approval or such determination with the Secretary of the Resources Agency. Such notice shall indicate the determination of the agency, board, or commission whether the project will, or will not, have a significant effect on the environment and shall indicate whether an environmental impact report has been prepared pursuant to the provisions of this division.

(b) Whenever a state agency, board, or commission determines that a project is not subject to the provisions of this division pursuant to subdivision (b) of Section 21080 or pursuant to Section 21085 or 21172, and it approves or determines to carry out such project, it, or the person specified in subdivision (b) or (c) of Section 21065, may file notice of such determination with the Secretary of the Resources Agency. Any notice filed pursuant to this subdivision by a person specified in subdivision (b) or (c) of Section 21065 shall have a certificate of determination attached to it issued by the state agency, board, or commission responsible for making the determination that a project is not subject to the provisions of this division pursuant to subdivision (b) of Section 21080 or pursuant to Section 21085 or 21172. The certificate of determination may be in the form of a certified copy of an existing document or record of the state agency, board, or commission.

(c) All notices filed pursuant to this section shall be available for public inspection, and a list of such notices shall be posted on a weekly basis in the Office of the Resources Agency. Each such list shall remain posted for a period of 30 days.

21150. State agencies, boards, and commissions responsible for allocating state or federal funds on a project-by-project basis to local agencies for any project which may have a significant effect on the environment, shall require from the responsible local governmental agency a detailed statement setting forth the matters specified in Section 21100 prior to the allocation of any funds other than funds solely for projects involving only feasibility or planning studies for possible future actions which the agency, board, or commission has not approved, adopted, or funded.

21151. All local agencies shall prepare, or cause to be prepared by contract, and certify the completion of an environmental impact report on any project they intend to carry out or approve which may have a significant effect on the environment. When a report is required by Section 65402 of the Government Code, the environmental impact report may be submitted as a part of that report.

21152. [Amended by AB 2338, Chap. 56, 1974.] (a) Whenever a local agency approves or determines to carry out a project which is subject to the provisions of this division, it shall file notice of such approval or such determination with the county clerk of the county, or counties, in which the project will be located. Such notice shall indicate the determination of the local agency whether the project will, or will not, have a significant effect on the environment and shall indicate whether an environmental impact report has been prepared pursuant to the provisions of this division.

(b) Whenever a local agency determines that a project is not subject to the provisions of this division pursuant to subdivision (b) of Section 21080 or pursuant to Section 21085 or 21172, and it approves or determines to carry out such a project, it, or the person specified in subdivision (b) or (c) of Section 21065, may file notice of such determination with the county clerk of the county, or counties, in which the project will be located. Any notice filed pursuant to this subdivision by a person specified in subdivision (b) or (c) of Section 21065 shall have a certificate of determination attached to it issued by the local agency responsible for making the determination that a project is not subject to the provisions of this division pursuant to subdivision (b) of Section 21080 or pursuant to Section 21085 or 21172. The certificate of determination may be in the form of a certified copy of an existing document or record of the local agency.

(c) All notices filed pursuant to this section shall be available for public inspection, and a list of such notices shall be posted on a weekly basis in the office of the county clerk. Each such list shall remain posted for a period of 30 days.

21153. Prior to completing an environmental impact report, every local agency shall consult with, and obtain comments from, any public agency which has jurisdiction by law with respect to the project, and may consult with any person who has special expertise with respect to any environmental impact involved.

21154. Whenever any state agency, board, or commission issues an order which requires a local agency to carry out a project which may have a significant effect on the environment, any environmental impact report which the local agency may prepare shall be limited to consideration of those factors and alternatives which will not conflict with such order.

21160. Whenever any person applies to any public agency for a lease, permit, license, certificate, or other entitlement for use, the public agency may require that person to submit data and information which may be necessary to enable the public agency to determine whether the proposed project may have a significant effect on the environment or to prepare an environmental impact report.

If any or all of the information so submitted is a "trade secret" as defined in Section 6254.7 of the Government Code by those submitting that information, it shall not be included in the impact report or otherwise disclosed by any public agency. This section shall not be construed to prohibit the exchange of properly designated trade secrets between public agencies who have lawful jurisdiction over the preparation of the impact report.

21161. Whenever a public agency has completed an environmental impact report, it shall cause a notice of completion of such report to be filed with the Secretary of the Resources Agency. The notice of completion shall briefly identify the project and shall indicate that an environmental impact report has been prepared. Failure to file the notice required by this section shall not affect the validity of a project.

21165. When a project is to be carried out or approved by two or more public agencies, the determination of whether the project may have a significant effect on the environment shall be made by the lead agency and such agency shall prepare, or cause to be prepared by contract, the environmental impact report for the project, if such a report is required by this division. In the event that a dispute arises as to which is the lead agency, any public agency may submit the question to the Office of Planning and Research, and the Office of Planning and Research shall designate the lead agency, giving due consideration to the capacity of such agency to adequately fulfill the requirements of this division.

21166. When an environmental impact report has been prepared for a project pursuant to this division, no subsequent environmental impact report shall be required unless either of the following occurs:

(a) Substantial changes are proposed in the project which will require major revisions of the environmental impact report.

(b) Substantial changes occur with respect to the circumstances under which the project is being undertaken which will require major revision in the environmental impact report.

21167. [Amended by AB 2338, Chap. 56, 1974.] Any action or proceeding to attack, review, set aside, void, or annul the following acts or decisions of a public agency on the grounds of noncompliance with this division shall be commenced as follows:

(a) An action or proceeding alleging that a public agency is carrying out or has approved a project which may have a significant effect on the environment without having determined whether the project may have a significant effect on the environment shall be commenced within 180 days of the public agency's decision to carry out or approve the project, or, if a project is undertaken without a formal decision by the public agency, within 180 days after commencement of the project.

(b) Any action or proceeding alleging that a public agency has improperly determined whether a project may have a significant effect on the environment shall be commenced within 30 days after the filing of the notice required by subdivision (a) of Section 21108 or subdivision (a) of Section 21152.

(c) Any action or proceeding alleging that an environmental impact report does not comply with the provisions of this division shall be commenced within 30 days after the filing of the notice required by subdivision (a) of Section 21108 or subdivision (a) of Section 21152.

(d) Any action or proceeding alleging that a public agency has improperly determined that a project is not subject to the provisions of this division pursuant to subdivision (b) of Section 21080 or pursuant to Section 21085 or 21172 shall be commenced within 35 days after the filing by the public agency, or person specified in subdivision (b) or (c) of Section 21065, of the notice authorized by subdivision (b) of Section 21108 or subdivision (b) of Section 21152. If such notice has not been filed, such action or proceeding shall be commenced within 180 days of the public agency's decision to carry out or approve the project, or, if a project is undertaken without a formal decision by the public agency, within 180 days after commencement of the project.

(e) Any action or proceeding alleging that any other act or omission of a public agency does not comply with the provisions of this division shall be commenced within 30 days after the filing of the notice required by subdivision (a) of Section 21108 or subdivision (a) of Section 21152.

21167.5. Proof of prior service by mail upon the public agency carrying out or approving the project of a written notice of the commencement of any action or proceeding described in Section 21167 identifying the project shall be filed concurrently with the initial pleading in such action or proceeding.

21168. Any action or proceeding to attack, review, set aside, void or annul a determination or decision of a public agency, made as a result of a proceeding in which by law a hearing is required to be given, evidence is required to be taken and discretion in the determination of facts is vested in a public agency, on the grounds of noncompliance with the provisions of this division shall be in accordance with the provisions of Section 1094.5 of the Code of Civil Procedure.

In any such action, the court shall not exercise its independent judgment on the evidence but shall only determine whether the act or decision is supported by substantial evidence in the light of the whole record.

21168.5. In any action or proceeding, other than an action or proceeding under Section 21168, to attack, review, set aside, void or annul a determination or decision of a public agency on the grounds of noncompliance with this division, the inquiry shall extend only to whether there was a prejudicial abuse of discretion. Abuse of discretion is established if the agency has not proceeded in a manner required by law or if the determination or decision is not supported by substantial evidence.

21168.6. In any action or proceeding under Sections 21168 or 21168.5 against the Public Utilities Commission the writ of mandate shall lie only from the Supreme Court to such commission.

21168.7. Sections 21168 and 21168.5 are declaratory to existing law with respect to the judicial review of determinations or decisions of public agencies made pursuant to this division.

21169. Any project defined in subdivision (c) of Section 21065 undertaken, carried out or approved on or before the effective date of this section and the issuance by any public agency of any lease, permit, license, certificate or other entitlement for use executed or issued on or before the effective date of this section notwithstanding a failure to comply with this division, if otherwise legal and valid, is hereby confirmed, validated and declared legally effective. Any project undertaken by a person which was supported in whole or part through contracts with one or more public agencies on or before the effective date of this section, notwithstanding a failure to comply with this division, if otherwise legal and valid, is hereby confirmed, validated and declared legally effective.

21170. (a) Section 21169 shall not operate to confirm, validate or give legal effect to any project the legality of which was being contested in a judicial proceeding in which proceeding the pleadings, prior to the effective date of this section, alleged facts constituting a cause of sufficient, shall, when completed, be deemed to be in compliance with this division and no further environmental impact report shall be required except as provided in Section 21166.

21173. If any provision of this division or the application thereof to any person or circumstances is held invalid, such invalidity shall not affect other provisions or applications of this division which can be given effect without the invalid provision or application thereof, and to this end the provisions of this division are severable.

21174. No provision of this division is a limitation or restriction on the power or authority of any public agency in the enforcement or administration of any provision of law which it is specifically permitted or required to enforce or administer including, but not limited to, the powers and authority granted to the California Coastal Zone Conservation Commission or any regional coastal zone conservation commission pursuant to Division 18 (commencing with Section 27000) of the Public Resources Code. To the extent of any inconsistency or conflict between the provisions of the California Coastal Zone Conservation Act of 1972, Division 18 (commencing with Section 27000) of the Public Resources Code, and the provisions of this division, the provisions of Division 18 (commencing with Section 27000) of the Public Resources Code shall control.

# APPENDIX J

I. Determination of compliance with emission limits (State of Texas). In most cases downwind samples will suffice; however, if the sampled properties are suspected of being influenced by an upwind source of $H_2S$, then both upwind and downwind samples will be taken. The concentration of $H_2S$ in the "downwind sample" less the concentration in the "upwind sample" shall be used in determining whether the emissions from the property comply with the requirements of Rule 203 of this Regulation. Calculated maximum allowable emission rates or ground level concentrations which are obtained by the Method in Section II below may be used in determining whether a property is in compliance with the emission limits specified.

II. Calculations of $H_2S$ Concentrations from Stack Samples and Measurements. The maximum allowable $H_2S$ emission rate which may be made from a stack on a property to comply with the emission limit set forth in Rule 203 of this Regulation may be calculated by Sutton's equation which has been modified to consider the critical wind speed and to correspond to a 30 minute air sample. Additional credit on stack emissions can be obtained if the distance from the stack to the property line is greater than thirty (30) stack heights. Those properties with greater than 30 stack heights to the property line should contact the Executive Director to obtain the proper correction factor.

A. For exit stack gas for temperatures of less than 125°F.

1. Rule 203.1. The $H_2S$ ambient air level is 0.08 ppm for 30 minutes.

$$Qa = 8 \times 10^{-4} V_s d_s^{2} \frac{1}{\left[\frac{d_s}{h_s}\right]^{1.29}} \qquad (1)$$

where:
$Qa$ = emission rate, lbs/hr
$V_s$ = stack exit velocity, ft/sec.
$d_s$ = exit stack diameter, ft.
$h_s$ = physical stack height, ft.
To plot Graph II, assume a basic stack height of 100 ft. and plot $\left[\frac{d_s}{100}\right]^{1.29}$ for various stack diameters versus stack velocity.

2. Rule 203.2. The $H_2S$ ambient air level of 0.12 ppm for 30 minutes.

$$Q_a = 12 \times 10^{-4} V_s d_s^2 \frac{1}{\left[\frac{d_s}{h_s}\right]^{1.29}} \qquad (2)$$

Symbols same as in equation (1) above.

B. For exit stack gas for temperatures greater than 125°F.

1. Rule 203.1. The $H_2S$ ambient air level is 0.08 ppm for 30 minutes.

$$Q_a = 1.68 \times 10^{-3} V_s d_s \left[1.5 + 0.82\left(\frac{\Delta T}{T_s}\right) d_s\right] h_s \qquad (3)$$

Where:
$Qa$ = emission rate, lbs/hr
$V_s$ = stack exit velocity, ft/sec.
$d_s$ = exit stack diameter, ft.
$\Delta T$ = temperature difference between stack gas and the outdoor atmosphere in °Rankine. An outdoor temperature of 90°F. (550°R) is assumed in preparing dispersion graphs.
$T_s$ = stack exit temperature in °Rankine.

To plot Graph III assume a basic stack height of 100 ft. and an exit velocity of 20 ft/sec. Let stack gas temperature vary with stack diameter.

2. Rule 203.2. The $H_2S$ ambient air level is 0.12 ppm for 30 minutes.

$$Q_a = 2.52 \times 10^{-3} \quad V_s \, d_s \left[ 1.5 + 0.82 \left( \frac{\Delta T}{T_s} \right) d_s \right] h_s \qquad (4)$$

Symobls same as used in equation (3).

Example 1 (Temperature of stack gas less than 125°F.)

How many lbs/hr of $H_2S$ can be discharged from a 200 ft. stack having a 4 ft exit diameter (ID) and a 30 ft/sec exit gas velocity? The stack gases temperature is 100°F and the distance to property line is 3000 ft. Emissions under Rule 203.1.

Solution

1. The ratio of stack diameter to 100 ft. is $\frac{4}{100} = 0.04$
2. Enter ordinate of Graph II with 0.04; go horizontally to intersection of 30 ft/sec. velocity curve. At the intersection read on the abscissa 24 lbs/hr on (Rule 203.1) scale. This is the permitted value for a 100 ft. stack.
3. Correct emissions for a 200 ft. stack. Enter Graph I at 200 ft and obtain correction factor of 2.3. Thus the emissions become 24 x 2.3 = 55 lbs/hr.

Note: Less than 30 stack heights to property line - no credit.

Example 2 (Temperature of stack gas greater than 125°F.)

How many lbs/hr of $H_2S$ can be discharged from a 200 ft. stack having a 4 ft exit diameter (ID) and a 30 ft/sec exit gas velocity? The temperature of the exit gases is 400°F. Emissions under Rule 203.1.

Solution

1. Enter ordinate of Graph III with 400; go horizontally to intersection of 4 ft. diameter, read on the abscissa on Rule 203.1 scale 36 lbs/hr emission. This is permitted value for 100 ft stack and exit velocity of 20 ft/sec.
2. Correct for stack height of 200 ft. This is direct ratio and becomes $\frac{200'}{100'} = 2$. The emission now becomes 36 x 2 = 72 lbs/hr.

3. Correct for stack exit velocity of 30 ft/sec. This is a direct ratio and becomes $\frac{30}{20}$ = 1.5. The allowed emission now becomes 72 x 1.5 = 108 lbs/hr.

Note: Less than 30 stack heights to property line - no credit.

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# APPENDIX K
# California NPDES Procedures

## SUBCHAPTER 9. WASTE DISCHARGE REPORTS AND REQUIREMENTS

Article
1. Fees
2. Procedures for Filing Reports
3. Material Changes in Waste Discharges
4. Monitoring Program Reports, Time Schedules, and Technical Reports
5. Waste Discharges from Point Sources to the Navigable Waters

### Detailed Analysis

#### Article 1. Fees

Section
2200. Filing Fee Schedule
2201. Minor Discharges

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## Article 1. Fees

**2200. Filing Fee Schedule.** Each report of a waste discharge or of a material change in a waste discharge filed with a regional water quality control board pursuant to Section 13260 of the Water Code shall be accompanied by a filing fee in accordance with the following schedule:

**Note:** Filing fee will be returned if filing of report of waste discharge is waived pursuant to Water Code Section 13269.

No credit will be given for filing fees paid for previously submitted reports of waste discharge for which waste discharge requirements and/or NPDES permits have been issued.

Fees are to be calculated on the basis of the total flow, volume, number of animals, or area involved.

| Type of Waste Discharge and Description | Units | Fees[1] | | |
|---|---|---|---|---|
| | | Less than 0.01 mgd | From 0.01 mgd to 3.00 mgd | Greater than 3.00 mgd |
| *Domestic and Municipal:* Sewage or mixture of predominantly sewage and other wastes from districts, municipalities, communities, hospitals, schools and publicly or privately owned systems (excluding individual subsurface leaching systems disposing of less than 1,000 gallons per day). | mgd—[2] design flow | $100 | $ = 301 × Q + 97[3] | $1,000 |
| | | Less than 0.10 mgd | 0.10 mgd to 1.00 mgd | Greater than 1.00 mgd |
| *Industrial:* Liquid or semisolid wastes from any servicing, producing, manufacturing, or processing operation of whatever nature, including mining, gravel washing, geothermal operations, fish hatcheries, air conditioning, ship building and repairing, oil production, storage and disposal operations, water-well pumping. | mgd—[2] design flow or maximum rate of discharge | $100 | $1,000 × flow in mgd | $1,000 |
| | Flow not susceptible to measurement or estimate | | $250 | |
| | | Less than 10 acres | 10–500 acres | Greater than 500 acres |
| *Earthen Materials:* Wastes containing earthen materials including soil, clay, silt, and sand from any soil disturbing activity such as grading and movement of earth, road construction and development, logging operations and dry quarrying. | Acres—area in which soil will be disturbed | $20 | $2/acre | $1,000 |
| *Drilling and Exploratory Mining Operations:* | Radius of operation | $25 for all exploratory operations within a zone having a radius of one mile or less. $50 for all operations within a zone having a radius greater than one mile. | | |
| *Solid Waste Disposal:*<br>*Class I Site:* No limitations as to nature of waste handled. | All quantities | $1,000 | | |
| | | Under 25,000 cubic yards | 25,000–500,000 cubic yards | Over 500,000 cubic yards |
| *Class II Site:* Ordinary household and commercial refuse and other decomposable organic material. | Design volume of site in cubic yards | $200 | $200 = (1.6 × thousands of cubic yards) | $1,000 |

| Type of Waste Discharge and Description | Units | Fees [1] | | |
|---|---|---|---|---|
| *Class III Site:*<br>Nonwater soluble, nondecomposable inert solids. | Flat fee | $100 | | |
| | | Under 25,000 cubic yards | 25,000-500,000 cubic yards | Over 500,000 cubic yards |
| *Dredging:*<br>Dredging operations with spoils disposal, such as navigational dredging, marina development and stream bed modification. | Quantity of material to be dredged | $100 | $100 + (1.8 × thousands of cubic yards) | $1,000 |
| | | Under 500 tons day | 500-5,000 tons day | Over 5,000 tons day |
| Product dredging operations, such as sand, gravel or mineral removal. | Maximum daily production rate | $100 | $0.20 × (tons day) | $1,000 |
| *Animal Confinement:* | | | | |
| Flow-thru drinking troughs with no process waste water. | Flat fee | $25 | | |
| Process wastes from confined holding or feeding areas: | | | | |
| | | Less than 200 head | 200 to 4,000 head | More than 4,000 head |
| Slaughter and feeder cattle | No. of head (design capacity) | $50 | $0.25/ head | $1,000 |
| | | Less than 125 head | 125 to 2,500 head | More than 2,500 head |
| Dairy | No. of head (design capacity) | $50 | $0.40/ head | $1,000 |
| | | Less than 500 head | 500 to 10,000 head | More than 10,000 head |
| Swine | No. of head (design capacity) | $50 | $0.10/ head | $1,000 |

| Type of Waste Discharge and Description | Units | Fees [1] | | |
|---|---|---|---|---|
| | | Less than 2,000 head | 2,000 to 40,000 head | More than 40,000 head |
| **Sheep** | No. of head (design capacity) | $50 | $0.025/ head | $1,000 |
| **Combination** | Cattle (No. head) × (0.25/head) =<br>Dairy (No. head) × (0.40/head) =<br>Swine (No. head) × (0.10/head) =<br>Sheep (No. head) × (0.025/head) =<br>Total = $ | | | |
| | | Less than 10,000 birds | 10,000 to 200,000 birds | More than 200,000 birds |
| **Turkeys** | No. of birds (design capacity) | $50 | $0.005/ bird | $1,000 |
| | | Less than 20,000 birds | 20,000 to 400,000 birds | More than 400,000 birds |
| **Laying Hens and Broilers (continuous flow watering)** | No. of birds (design capacity) | $50 | $0.0025/ bird | $1,000 |
| | | Less than 5,000 birds | 5,000 to 100,000 birds | More than 100,000 birds |
| **Laying Hens and Broilers (liquid manure handling)** | No. of birds (design capacity) | $50 | $0.01/ bird | $1,000 |
| | | Less than 1,000 birds | 1,000 to 20,000 birds | More than 20,000 birds |
| **Ducks** | No. of birds (design capacity) | $50 | $0.05/ bird | $1,000 |
| *Irrigation Return Waters:* | Flat fee | $25 | | |

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[1] Fees are rounded off to the nearest dollar.
[2] mgd = million gallons per day.
[3] Q = Design Flow (mgd).

**NOTE: Authority cited for Subchapter 9: Sections 185 and 13260(d), Water Code. Reference: Article 4 (commencing with § 13260) of Chap. 4 of Div. 7, Water Code.**

*History:* 1. **New Subchapter 9 (Sections 2200, 2205 through 2207 and 2210) filed 12-5-69; effective thirtieth day thereafter (Register 69, No. 49).**
2. Amendment filed 7-2-71; effective thirtieth day thereafter (Register 71, No. 27).
3. Editorial correction (Register 72, No. 41).
4. Amendment filed 5-22-74; effective thirtieth day thereafter (Register 74, No. 21).
5. Amendment filed 10-31-74; effective thirtieth day thereafter (Register 74, No. 44).
6. Amendment filed 1-24-75 as procedural and organizational; effective upon filing (Register 75, No. 4).

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**2201. Minor Discharges.** Notwithstanding any other section in this subchapter, dischargers who discharge no more than 50,000 gallons per calendar day of cooling water, water well start-up water or other water which contains only insignificant amounts of pollutants and no toxic materials, will be subject to a $25.00 filing fee and reports of self-monitoring may be submitted on an annual basis or at a frequency which is reasonable as determined by the Regional Board.

NOTE: Authority cited: Sections 1058 and 13260(d), Water Code. Reference: Chapter 4, Article 4 (commencing with Section 13260) of Division 7, Water Code.

*History:* 1. New section filed 7-25-74 as an emergency; effective upon filing (Register 74, No. 30).

2. Certificate of Compliance filed 11-22-74 (Register 74, No. 47).

## Article 2. Procedures for Filing Reports

**2205. Preliminary Procedures.** Each waste discharge report together with the required filing fee shall be submitted to the appropriate regional board on a form supplied by the board. The report shall contain all the available information required by the form and shall be sworn to or submitted under penalty of perjury. The board will promptly notify the sender of any additional information that is needed and of any additional fee that is due. Pursuant to Section 13269 of the Water Code, the board may waive the filing of a report, in which case it will notify the sender and return any fee that has been paid.

**2206. Effective Filing Date.** When the discharger has submitted all the information required by the regional board and the full fee that is due, the report will be deemed filed within the meaning of Section 13264 of the Water Code and for all other purposes. The discharger will be notified to that effect.

**2207. Criteria for Filing Reports.** Separate reports shall be filed for discharges to different disposal areas. One report may include two or more discharges by the same person to the same disposal area unless in the judgment of the regional board separate reports should be filed.

## Article 3. Material Changes in Waste Discharges

**2210. Definition of a Material Change.** A material change requiring a revised waste discharge report may be any of the following:

(a) Addition of a major industrial waste discharge to a discharge of essentially domestic sewage, or the addition of a new process or product by an industrial facility resulting in a change in the character of the waste.

(b) Significant change in disposal method, e.g., change from a land disposal to a direct discharge to water, or change in the method of treatment which would significantly alter the characteristics of the waste.

(c) Significant change in the disposal area, e.g., moving the discharge to another drainage area, to a different water body, or to a disposal area significantly removed from the original area potentially causing different water quality or nuisance problems.

(d) Increase in flow beyond that specified in the waste discharge requirements.

(e) Increase in area or depth to be used for solid waste disposal beyond that specified in the waste discharge requirements.

(f) Other circumstances which result in a material change in character, amount or location of waste discharge.

*History:* 1. Amendment filed 12-3-70; effective thirtieth day thereafter (Register 70, No. 49).

## Article 4. Solid Waste Disposal

*History:* 1. New Article 4 (Sections 2215 and 2216) filed 12-3-70; effective thirtieth day thereafter (Register 70, No. 49).
2. Repealer of Article 4 (Sections 2215 and 2216) filed 3-10-72; effective thirtieth day thereafter (Register 72, No. 11).

## Article 4. Monitoring Program Reports, Time Schedules, and Technical Reports

**2230. Monitoring Program Reports.** (a) For flows up to 0.25 million gallons per day and for solid waste disposal sites with a rate of discharge up to 200 tons per day, monitoring reports shall be required at least quarterly.

(b) For flows of 0.25 million gallons per day and greater and for solid waste disposal sites with a rate of discharge greater than 200 tons per day, monitoring reports should be submitted at least monthly.

(c) Parameters should include all those specified in the requirements.

(d) Intensive monitoring shall be required where concentrations of substances critical to downstream beneficial uses can be expected to vary greatly.

(e) Each discharger with a monitoring program should be required to submit an annual report by January 30 summarizing the monitoring data for the previous year.

(f) Water quality analysis shall be required to be performed in accordance with the latest edition of "Guidelines Establishing Test Procedures for Analysis of Pollutants", promulgated by the United States Environmental Protection Agency.

(g) Chemical, bacteriological, and bioassay analyses shall be required to be conducted at a laboratory certified for such analyses by the State Department of Health. In the event a certified laboratory is not available to the discharger, the executive officer may accept analyses performed by a noncertified laboratory for a two-year period subsequent to the adoption of these regulations provided that the laboratory has applied for certification.

NOTE: Authority cited: Section 185, Water Code. Reference: Chapters 4, 5 and 8 of Division 7, Water Code.

*History:* 1. New Article 5 (§§ 2230, 2231 and 2232) filed 12-3-70; effective thirtieth day thereafter (Register 70, No. 49).
2. Renumbering of Article 5 to 4 filed 3-10-72; effective thirtieth day thereafter (Register 72, No. 11).
3. Amendment of subsections (f) and (g) filed 5-22-75, effective thirtieth day thereafter (Register 75, No. 21).

**2231. Time Schedules.** (a) Time schedules should be included in requirements for existing discharges when it appears that the discharger cannot immediately meet the requirements.

(b) Time schedules shall not permit any unnecessary time lag, and periodic status reports should be required.

(c) Time schedules should include only dates for complete design, complete financial arrangements, start of construction, 50 percent completion of work, and full compliance with requirements.

(d) Time schedules should be periodically reviewed and should be updated, when necessary, to assure the most rapid compliance.

**2232. Technical Reports.** (a) When the flow volume of a domestic discharge, subject to a self-monitoring program, from a community reaches 75 percent of that for which the requirements are set, the discharger shall be required to submit a technical report showing how volumes of effluent in excess of that for which the requirements are established will be treated and disposed of, or how flow volumes will be prevented from increasing beyond that permitted by the requirements.

(b) A technical report should be required when any parameter in the requirements is threatened to be violated by additional loadings.

*History:* 1. Repealer of subsection (c) filed 3-10-72; effective thirtieth day thereafter (Register 72, No. 11).

**2232 1. Certification of Supervisors and Operators of Municipal Wastewater Treatment Plants.** A condition shall be included in waste discharge requirements for a publicly owned wastewater treatment plant requiring that supervisors and operators of said plant shall possess a certificate of appropriate grade in accordance with regulations adopted by the state board.

NOTE: Authority cited: Section 1058, Water Code. Reference: Chapter 9 (commencing with Section 13625 of Division 7), Water Code.

*History:* 1. New section filed 9-24-75; effective thirtieth day thereafter (Register 75, No. 39).

## Article 5. Waste Discharges from Point Sources to Navigable Waters

**2235. Definitions.** The following definitions shall apply to this article:

(a) "Navigable waters" mean the waters of the United States, including the territorial sea.

(b) "Report of waste discharge" is the equivalent of an application for a National Pollutant Discharge Elimination System Permit (NPDES).

(c) "Administrator" means the administrator of the Environmental Protection Agency (EPA).

(d) "Regional administrator" means the regional administrator of Region IX of the EPA.

(e) "Minor discharge" means any discharge or discharges from a single facility which (1) have a total volume of less than 50,000 gallons on every day of the year, (2) do not affect the waters of any other state, and (3) are not identified by the regional board executive officer, the state board executive officer, the regional administrator, or by the administrator in regulations pursuant to Section 307(a) of the Federal Water Pollution Control Act as a discharge which is not minor.

(f) "Pollutant" means dredged spoil, solid wastes, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal and agricultural waste discharged into navigable waters.

(g) "Point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged.

NOTE: Authority cited: Section 1058, Water Code. Reference: Chap. 5.5 (commencing with Sec. 13370) of Div. 7, Water Code.

*History:* 1. New Article 5 (§§ 2235, 2235.1 through 2235.18) filed 2-5-73 as an emergency; effective upon filing (Register 73, No. 6).
2. Amendment of subsections (a) and (f) filed 4-6-73 as an emergency; effective upon filing (Register 73, No. 14).
3. Certificate of Compliance filed 6-13-73 (Register 73, No. 24).

**2235.1. Filing a Report of Waste Discharge.** (a) Any person presently discharging pollutants to navigable waters must file a report of waste discharge with the appropriate regional board (1) within 45 days of a written request by the regional board or the state board or (2) by April 16, 1973, whichever is sooner.

(b) Any person proposing to commence a discharge of pollutants after March 31, 1973, must file a complete report of waste discharge (1) no less than 180 days in advance of the date on which it is desired to commence the discharge of pollutants or (2) in sufficient time prior to commencement of the discharge of pollutants to insure compliance with the requirements of Section 306 of the Federal Water Pollution Control Act (P.L. 92-500) and any other applicable water quality standards, effluent standards and limitations, or with any applicable zoning or siting requirement established pursuant to Section 208 of the Federal Water Pollution Control Act.

(c) The requirement for a report of waste discharge will be satisfied if the discharger files:

(1) A complete Refuse Act application filed pursuant to 33 U.S.C. 407, Executive Order No. 11574, 35 Federal Register 19627 (1970), or

(2) A complete NPDES application form which is appropriate for the type, category, or size of discharge, and

(3) Any additional information required by the regional board executive officer.

(d) A new report shall be required 120 days prior to any of the following:

(1) Addition of a major industrial waste discharge of essentially domestic sewage, or the addition of a new process or product by an industrial facility resulting in a change in the character of the waste.

(2) Significant change in disposal method (e.g., change from a land disposal to a direct discharge to water, or change in the method of treatment which would significantly alter the characteristics of the waste).

(3) Significant change in the disposal area (e.g., moving the discharge to another drainage area, to a different water body, or to a disposal area significantly removed from the original area potentially causing different water quality or nuisance problems).

(4) Increase in flow beyond that specified in the waste discharge requirements.

(5) Other circumstances which result in a material change in character, amount or location of waste discharge.

(e) The report of waste discharge shall bear a certification of correctness to be signed:

(1) In the case of corporations, by a principal executive officer at least of the level of vice president or his duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge originates.

(2) In the case of a partnership, by a general partner.

(3) In the case of a sole proprietorship, by the proprietor.

(4) In the case of a municipal, state, or other public facility, by either a principal executive officer, ranking elected official, or other duly authorized employee.

(f) No waste discharge requirement will be adopted on the basis of any Refuse Act or NPDES application which the regional administrator has identified as incomplete or otherwise deficient until the regional board executive officer receives sufficient information to correct any deficiency.

*History:* 1. Amendment of subsection (b) filed 4-6-73 as an emergency; effective upon filing (Register 73, No. 14).
2. Certificate of Compliance filed 6-13-73 (Register 73, No. 24).

**2235.2. Transmission of Data to EPA and Time for Comment on Completeness.** (a) The regional board executive officer shall, within 15 days of receipt of a report of waste discharge, transmit a copy of the report of waste discharge to the regional administrator for a review of completeness. (Note: This procedure shall not apply when the regional administrator has waived, in writing, the receipt of any such reports.)

(b) The regional administrator shall have 20 days to comment or object in writing to any deficiency in the report of waste discharge.

**2235.3. Regional Board Staff Procedures for Determining if a Report of Waste Discharge Is Complete.** (a) Upon receipt of a report of waste discharge, the report is forwarded promptly to the regional administrator and review by the regional board staff for completeness.

(b) The regional board executive officer shall not notify the discharger of the status of the report of waste discharge until he has received the comments of the regional administrator, unless waived or the 20-day comment period has elapsed.

(c) If the report is incomplete, the regional board executive officer should request from the discharger such information as is required to complete the report.

(d) No further administrative action shall be taken until a complete report is filed.

(e) Any additional information received shall be forwarded promptly by the regional board executive officer to the regional administrator.

(f) Once a report is deemed complete, a copy should be mailed to the national data bank and an acknowledgment sent by the regional board executive officer to the discharger.

**2235.4. Regional Board Processing of Completed Reports of Waste Discharge.** (a) Formulation of tentative waste discharge requirements, time schedules, monitoring programs and other necessary conditions.

(1) The regional board executive officer shall review the report of waste discharge and any other relevant facts to determine if waste discharge requirements should be issued or the discharge should be prohibited.

(2) If issuing waste discharge requirements for a discharge is not desirable, the regional board executive officer shall prepare a staff report specifying the reasons why waste discharge requirements should not be issued. This report should be processed in the same manner as proposed waste discharge requirements.

(3) If issuing waste discharge requirements is desirable, the regional board executive officer shall formulate tentative waste discharge requirements including:

(A) Proposed effluent limitations.

(B) Proposed time schedule for compliance including any necessary interim dates.

(C) Proposed special conditions.

(D) Proposed monitoring program.

**(b) Public notice of report of waste discharge.**

(1) After formulation of tentative waste discharge requirements, a public notice of report of waste discharge shall be prepared by the regional board executive officer.

(2) A copy of the notice shall be mailed by the regional board executive officer to the discharger with instructions for circulation of the notice within the geographical areas of the proposed discharge. Such instructions for circulation of the notice shall require any or all of the following:

(A) Posting in the post office and public places of the municipality nearest the premises of the discharger in which the effluent source is located.

(B) Posting near the entrance to the discharger's premises and in nearby places.

(C) Publication in local newspapers or in a daily newspaper of general circulation. For major or controversial discharges, the notice shall be published at least five consecutive days.

Proof of posting and/or publication of the notice shall be submitted to the regional board executive officer within 15 days of the posting or of the publication if the notice was published. Such proof shall be by affidavit of the publisher or foreman of the newspaper or of the person who posted the notice.

(3) The notice shall be mailed by the regional board executive officer to persons known to be interested, persons requesting such notice, and interested governmental agencies.

(4) The notice shall allow not less than 30 days for comment.

(5) All comments received regarding the public notice shall be filed permanently with the regional board and given full and appropriate consideration in making any final decision.

(c) **Fact sheets.**

(1) For every discharge which has a total volume of more than 500,000 gallons on any day of the year, before publication of notice the regional board executive officer shall prepare a fact sheet concerning the proposed discharge. The fact sheet shall contain the following information:

(A) A sketch or detailed description of the location of the discharge.

(B) The rate and frequency of the proposed discharge.

(C) For thermal discharges, the average summer and winter temperature in degrees Fahrenheit.

(D) The average daily discharge in pounds per day of pollutants which are subject to limitations.

(E) A statement of the intent to issue waste discharge requirements.

(F) A list of beneficial uses of the receiving waters.

(G) Summary of the applicable water quality standards and proposed effluent limitation.

(H) A notice of the time period for comment, the person to whom comments should be addressed, and the date of public hearing.

(2) At the time of issuance of a public notice of report of waste discharge, the public notice together with any necessary fact sheet and tentative waste discharge requirements and proposed monitoring programs shall be transmitted to:

(A) Other states or interstate agencies having jurisdiction over waters which may be affected by issuance of waste discharge requirements.

(B) The regional administrator of EPA.

(C) The district engineer, Army Corps of Engineers, and any other interested federal agencies.

(D) The State Departments of Fish and Game, Health and Water Resources.

(E) The agency responsible for preparation of an approved plan pursuant to Section 208(b) of the Federal Water Pollution Control Act.

(F) The state or interstate agency responsible for preparation of a plan pursuant to an approved continuous planning process under Section 303(e) of the Federal Water Pollution Control Act.

(3) The public notice, fact sheet, and tentative waste discharge requirements shall be provided to any other person upon request.

(4) Upon request, the regional board executive officer shall add the name of any person or group to a mailing list to receive copies of the public notice, fact sheets and tentative waste discharge requirements.

(5) Upon request, any affected state or interstate agency having jurisdiction over any surface water which may be affected by issuance of waste discharge requirements shall be supplied a copy of the report of waste discharge.

(6) Each affected state or interstate agency shall be afforded 30 days in which to submit written recommendations to the regional board executive officer and to the regional administrator. Should the regional board executive officer fail to incorporate any written recommendation thus received, he shall provide a written explanation of his decision to the affected state and regional administrator.

(d) **Public access to information.**

(1) The report of waste discharge, along with all other pertinent material, not determined to be confidential, pertaining to the discharge shall be available to the public for inspection and copying.

(2) The regional board executive officer shall provide facilities for the inspection of information and shall make arrangements with a copying service for the copying of information. Any person requesting copies of any information must contact the copying service directly and request the service and inform the regional board executive officer of the exact documents of which copies are requested.

(3) The regional board executive officer may protect any information (other than effluent data) contained in a report of waste discharge as confidential pursuant to the provisions of the California Public Records Act. The regional board executive officer shall request the concurrence of the regional administrator in the classification of information contained in a NPDES application form as confidential. If such concurrence is withheld the regional board executive officer shall disclose the information upon request.

(4) Any information accorded confidential status shall be disclosed upon request to other state and federal agencies.

(e) **Public hearings.**

(1) The regional board shall adopt waste discharge requirements only after notice and opportunity for public hearing. Requirements unopposed may be placed on the board's agenda under "consent items" and the board may adopt these waste discharge requirements without discussion.

(2) Hearings will be held in a suitable location of convenient access in the geographical region of the discharge.

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(f) **Public notice of public hearings.**

(1) The public notice of the public hearing shall be circulated at least as widely as was the Notice of the Report of Waste Discharge.

(2) Notice shall be published by the regional board executive officer in at least one newspaper of general circulation within the geographical area of the discharge.

(3) Notice shall be sent to all persons and public agencies which received a copy of the notice or fact sheet for the report of waste discharge.

(4) Notice shall be mailed to any person or group upon request.

(5) Notice may be published at any time after the publication of a notice of report of waste discharge but at least 30 days in advance of the hearing.

(6) Notices for more than one hearing to be held at the same time and place may be combined.

*History:* 1. Amendment filed 4-6-73 as an emergency; effective upon filing (Register 73, No. 14).
2. Certificate of Compliance filed 6-13-73 (Register 73, No. 24).
3. Amendment of subsection (b) filed 3-8-74; effective thirtieth day thereafter (Register 74, No. 10).

**2235.5. Formulation of Waste Discharge Requirements.** (a) **Prohibitions.**

(1) No waste discharge requirements will be issued if:

(A) The discharge contains a radiological, chemical, or biological warfare agent or high level radioactive waste.

(B) The secretary of the Army acting through the chief of engineers finds the discharge would substantially impair anchorage and navigation.

(C) The regional administrator has objected to issuance in writing.

(D) The discharge is in conflict with an approved plan pursuant to Section 208(b) of the Federal Water Pollution Control Act.

(b) **Application of effluent standards and limitations, water quality standards and other requirements.**

(1) All waste discharge requirements shall comply with effluent limits adopted under Sections 301, 302, 306 and 307 of the Federal Water Pollution Control Act and whenever applicable, any more stringent limitation necessary to meet water quality standards or prohibitions or comply with water quality control plans established under Division 7 of the California Water Code, any other federal law or regulation, any plan approved pursuant to Section 208(b) of the Federal Water Pollution Control Act any effluent limitation designed to achieve the requirements of Section 301(b) of the Federal Water Pollution Control Act. Prior to promulgation by the administrator of applicable effluent standards and limitations pursuant to Sections 301, 302, 306 and 307, waste discharge requirements shall contain effluent limits and other conditions

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necessary to carry out the provisions of the Federal Water Pollution Control Act.

(2) If a toxic effluent standard is established pursuant to Section 307 of the Federal Water Pollution Control Act for a toxic pollutant which is present in a discharge and such standard is more stringent than the current waste discharge requirement, the waste discharge requirements shall be revised in accordance with such toxic effluent standard.

(3) If the waste discharge requirements contain an effluent limitation for a parameter more stringent than the applicable effluent limitation for the parameter developed pursuant to Sections 301, 302, 306 and 307 of the Federal Water Pollution Act, a waste loading allocation must be prepared to insure that the discharge authorized is consistent with applicable water quality standards.

(4) Effluent limitations shall specify the average and maximum allowable mass emission of pollutants in terms of pounds per day or, if not appropriate, in another technically correct and precise manner.

(5) Time schedules.

(A) Waste discharge requirements also shall include a compliance time schedule for any discharge which is not in full compliance with all proposed effluent limitations and other requirements.

(B) The time schedule shall be in accordance with any legally applicable schedule of compliance contained in:

1. Applicable effluent standards and limitations; or,

2. If more stringent, water quality standards; or,

3. If more stringent, legally applicable plan or policy; or,

4. In the absence of any legally applicable schedule of compliance, in the shortest reasonable time period, such period not to extend beyond July 1, 1977.

(C) If a time schedule exceeds nine months, one or more interim reporting dates shall be required; in no event shall more than nine months elapse between interim dates contained in a time schedule.

(D) Either before or up to 14 days following each interim date the discharger shall be required to provide the regional board executive officer with a written notice of progress toward compliance with interim or final reporting tasks.

(E) The regional board may suspend or revoke any waste discharge requirement for failure to comply with all provisions of an applicable time schedule.

(F) On the last day of the months of February, May, August, and November, the regional board executive officer shall transmit to the regional administrator, with a copy to the state board, a list of all instances, as of 30 days prior to the date of such report, of failure or refusal of a permittee to comply with interim or final requirements or to notify the regional board of compliance or noncompliance with each interim or final requirement. Such list shall be available to the public for inspection and copying and shall contain at least the following information with respect to each instance of noncompliance.

1. Name and address of each noncomplying permittee:

2. A short description of each instance of noncompliance (e.g., failure to submit preliminary plans, two-week delay in commencement of construction of treatment facility, failure to notify regional board of compliance with interim requirements to complete construction by June 30, etc.);

3. A short description of any actions or proposed actions by the permittee or the regional board executive officer to comply or enforce compliance with the interim or final requirements; and

4. Any details which tend to explain or mitigate an instance of noncompliance with an interim or final requirement (e.g., construction delayed due to materials delay, strike).

(G) The regional board may, upon request of the discharger, modify or revise a schedule of compliance if good and valid cause exists for such revision and if within 30 days following receipt of notice from the regional board, the regional administrator does not object in writing. All revisions or modifications made during the period ending 30 days prior to the date of transmission of the list prepared under (F) above shall be included in such list.

*History:* 1. Amendment of subsections (b)(1) and (b)(5)(H) filed 4-6-73 as an emergency; effective upon filing (Register 73, No. 14).
2. Certificate of Compliance filed 6-13-73 (Register 73, No. 24).
3. Amendment of subsection (b)(5) filed 4-4-74 as procedural and organizational; effective upon filing (Register 74, No. 14).

**2235.6. Other Terms and Conditions to be Included in Waste Discharge Requirements.** (a) Any waste discharge requirements for a publicly owned treatment facility shall be conditioned upon the operating agency notifying the regional board of (1) new introduction into such works of pollutants from a source which would be a new source as defined in Section 306 of the Federal Water Pollution Control Act if such source were discharging pollutants to the navigable waters of the United States, (2) new introductions of pollutants into such works from a source which would be subject to Section 301 of the Federal Water Pollution Control Act if it were discharging such pollutants to the navigable waters of the United States, (3) a substantial change in the volume or character of pollutants being introduced into such works by a source introducing pollutants into such works at the time the waste discharge requirements were adopted. Notice shall include a description of the quantity and quality of pollutants and the impact of such change on the quantity and quality of effluent from such publicly owned treatment works. A substantial change in volume is considered an increase of ten percent in the mean dry weather flow rate. The discharger shall be directed to forward a copy of such notice directly to the regional administrator.

(b) A condition shall be included for a discharge from a publicly owned treatment works to comply with Sections 204(b), 307 and 308 of the Federal Water Pollution Control Act. The operator of the publicly owned treatment works shall require each industrial user to submit periodic notice (over intervals not to exceed nine months) of progress toward compliance with Section 307 requirements. The operator of the public treatment works shall be required to forward a copy of such notice to the regional board and the regional administrator.

(c) All discharges authorized by waste discharge requirements shall be consistent with the terms and conditions contained in such requirements. The discharge of any pollutant more frequently than or in excess of that identified and authorized by the requirements shall constitute a violation of the terms and conditions of the requirements.

(d) A condition shall be included to insure that the discharger shall maintain in good working order and operate as efficiently as possible any facility or control system installed by the discharger to achieve compliance with the waste discharge requirements.

(e) A condition shall be included in waste discharge requirements for a publicly owned wastewater treatment plant requiring that supervisors and operators of said plant shall possess a certificate of appropriate grade in accordance with regulations adopted by the state board.

*History:* 1. Amendment of subsection (c) filed 4-6-73 as an emergency; effective upon filing (Register 73, No. 14).
2. Certificate of Compliance filed 6-13-73 (Register 73, No. 24).
3. New subsection (e) filed 9-24-75; effective thirtieth day thereafter (Register 75, No. 39).

**2235.7. Duration of Waste Discharge Requirements.** (a) Waste discharge requirements shall be adopted for a fixed term not to exceed five years.

(b) Waste discharge requirements may be terminated or modified upon a finding by a regional board or the state board that (1) any condition contained in the requirements has been violated, (2) a requirement has been obtained by misrepresentation or failure to disclose fully all relevant facts, (3) there has been a change in any condition that requires a temporary or permanent reduction or elimination of the discharge, or for other good cause shown.

*History:* 1. Amendment of subsection (b) filed 8-23-74 as procedural and organizational; effective upon filing (Register 74, No. 34).

**2235.8. Transmission to Regional Administrator of Proposed Waste Discharge Requirements.**

*History:* 1. Repealer filed 4-6-73 as an emergency; effective upon filing (Register 73, No. 14).
2. Certificate of Compliance filed 6-13-73 (Register 73, No. 24).

**2235.9. Transmission to Regional Administrator of Adopted Waste Discharge Requirements.** Upon adoption of any waste discharge requirements, the regional board executive officer shall, within 30 days, forward to the regional administrator a copy of such requirements.

**2235.10. Reissuance of Requirements.** (a) At least 180 days prior to expiration of waste discharge requirements, a discharger wishing to continue a discharge shall file a new report of waste discharge, as required by the appropriate regional board. Requirements will not be reissued unless (1) the discharger is in compliance with or has substantially complied with all the terms, conditions, requirements and schedules of compliance contained in the existing waste discharge requirements, (2) the discharger files a new report of waste discharge and other necessary data as required by the regional board, and (3) the discharge is consistent with applicable effluent standards and limitations and water quality standards or prohibitions.

(b) The notice and hearing procedure for reissuance shall be the same as for the issuance of new requirements.

(c) Notwithstanding any other provision in this article, any point source the construction of which is commenced after the date of enactment of the Federal Water Pollution Control Act Amendments of 1972 (October 18, 1972) and which is so constructed as to meet all applicable standards of performance shall not be subject to any more stringent standard of performance during a 10-year period beginning on the date of completion of such construction or during the period of depreciation or amortization of such facility for the purposes of Section 167 or 169 (or both) of the Internal Revenue Code of 1954, whichever period ends first.

*History:* 1. Amendment of subsection (c) filed 4-6-73 as an emergency; effective upon filing (Register 73, No. 14).
2. Certificate of Compliance filed 6-16-73 (Register 73, No. 24).

**2235.11. Monitoring.** (a) An appropriate monitoring program shall be included in all orders containing waste discharge requirements. The program may require the discharger to install, use and maintain, at his expense, adequate monitoring equipment or methods (including, where appropriate, biological monitoring methods).

(b) Draft monitoring programs shall be forwarded to all interested persons with the tentative waste discharge requirements for review and comment.

(c) Any discharge which (1) is not a minor discharge, (2) the regional administrator requests in writing to be monitored, or (3) contains toxic pollutants for which an effluent standard has been established under Section 307(a) of the Federal Water Pollution Control Act shall be monitored by the discharger for at least the following:

(1) Flow (in gallons per day) and

(2) Pollutants which are subject to reduction or elimination under the requirements, pollutants which could have a significant impact on the quality of the receiving waters, and pollutants specified by the regional administrator.

(d) Each effluent flow or pollutant shall be monitored at intervals sufficiently frequent to yield data which reasonably characterize the nature of the discharge. Variable effluent flows and constituent levels shall be monitored at more frequent intervals.

*History:* 1. Amendment of subsection (b) filed 4-6-73 as an emergency; effective upon filing (Register 73, No. 14).
2. Certificate of Compliance filed 6-13-73 (Register 73, No. 24).

**2235.12. Recording.** (a) The discharger shall record the results of all monitoring and shall include for all samples:

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(1) The date, exact place, time of sampling, and who took the sample.

(2) The dates analyses were performed and who performed the analyses.

(3) Analytical techniques/methods used.

(4) The results of such analyses.

(b) The discharger shall be required to retain for a minimum of three years any records of monitoring activities and results including all original strip chart recordings and calibration and maintenance records. The period of retention shall be extended during the course of any unresolved administrative enforcement action or litigation regarding the discharge of pollutants by the discharger when requested by the regional board executive officer or the regional administrator.

**2235.13. Reporting.** (a) Monitoring results shall be reported on the proper NPDES reporting form and any necessary form required by the regional board.

(b) The discharger shall be directed to forward a copy of his monitoring data on the proper NPDES form directly to the regional administrator.

(c) For flows up to 0.25 million gallons per day, monitoring reports should be submitted at least quarterly. For flows of 0.25 million gallons per day and greater, monitoring reports should be submitted at least monthly.

(d) Monitoring requirements shall include any national monitoring and recording requirements specified in federal regulations.

(e) Each discharger with a monitoring program must be required to submit an annual report by January 30, summarizing the monitoring data for the previous year.

(f) Chemical, bacteriological, and bioassay analyses shall be required to be conducted at a laboratory certified for such analyses by the State Department of Health. In the event a certificated laboratory is not available to the discharger, the executive officer may accept analyses performed by a noncertified laboratory for a two-year period subsequent to the adoption of these regulations provided that the laboratory has applied for certification.

(g) Monitoring reports shall be signed by:

(1) In the case of corporations, by a principal executive officer at least of the level of vice president or his duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge originates.

(2) In the case of a partnership, by a general partner.

(3) In the case of a sole proprietorship, by the proprietor.

(4) In the case of a municipal, state or other public facility, by either a principal executive officer, ranking elected official, or other duly authorized employee.

*History:* 1. Amendment of subsection (f) filed 5-22-75; effective thirtieth day thereafter (Register 75, No. 21).

**2235.14. Technical Reports.** (a) When the flow volume of a domestic discharge from a publicly owned treatment facility reaches 75 percent of that for which the requirements are set, the discharger shall be required to submit a technical report showing how volumes of

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effluent in excess of that for which the requirements are established will be treated and disposed of, or how flow volumes will be prevented from increasing beyond that permitted by the requirements.

(b) A technical report should be required when any parameter in the requirements is threatened to be violated by additional loadings.

**2235.15. Compliance Determination.** Each regional board shall develop a schedule for inspection of all waste dischargers within the region to determine compliance with waste discharge requirements. Each discharge shall be inspected for compliance with discharge requirements at least annually.

**2235.16. Staff Procedures for Preparation and Presentation of the Agenda.** (a) The agenda item relating to adoption of tentative waste discharge requirements shall consist of a regional board executive officer summary report, fact sheet, tentative requirements (including time schedules), a monitoring program and any other necessary conditions.

(b) The regional board executive officer summary report should not in general exceed one page and shall discuss the salient features and controversial aspects of the proposed discharge.

(c) For the more complex cases, a staff report may be included following the regional board executive officer summary report.

(d) Correspondence from interested persons should not be included in the agenda folder but should be briefly summarized in the regional board executive officer summary report.

(e) Comments and recommendations of other governmental agencies which are not directly related to water quality shall not be incorporated within the agenda material and shall be transmitted to the discharger as a separate item, not part of the board order.

(f) The regional board executive officer or a member of his staff will present the pertinent facts regarding the tentative requirements at the board meeting.

(g) Senior professional staff should be present at meetings to answer specific technical questions.

(h) After requirements are adopted, copies shall be transmitted immediately to the discharger, each concerned agency, the state board, and other interested persons upon request.

*History:* 1. Amendment of subsections (a) and (f) filed 4-6-73 as an emergency; effective upon filing (Register 73, No. 14).
2. Certificate of Compliance filed 6-13-73 (Register 73, No. 24).

**2235.17. Emergency Notification of Regional Administrator.** In the event of an actual or threatened danger to the health or welfare of persons resulting from the discharge of pollutants, the regional board executive officer shall immediately notify by telephone the State Water Resources Control Board executive officer who shall transmit the information to the regional administrator.

**2235.18. Disposal of Pollutants Into Wells.** (a) Any proposal to discharge pollutants into wells shall be reviewed in accordance with Chapter 4 of Division 7 of the California Water Code and the procedures for implementation of Chapters 4 and 5 of that division.

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(b) If waste discharge requirements cannot be prescribed which fully protect all beneficial uses of any subsurface water, the discharge of pollutants into the subsurface water shall be prohibited.

(c) Appropriate monitoring of effluent and subsurface waters shall be required for each discharge of pollutants into wells.

**2235.19. Disposal of Sewage Sludge.** (a) In any case where the disposal of sewage sludge resulting from the operation of treatment works as defined in Section 212 of the Federal Water Pollution Control Act, (including the removal of in-place sewage sludge from one location and its deposit in another location) would result in any pollutant from such sewage sludge entering the navigable waters. Such disposal is prohibited except in accordance with waste discharge requirements adopted by the state board or a regional board and regulations adopted by the administrator.

*History:* 1. New section filed 1-6-73 as an emergency; effective upon filing (Register 73, No. 1).
2. Certificate of Compliance filed 6-16-73 (Register 73, No. 24).

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# APPENDIX L

## NEW MEXICO

## STREAM USE DESIGNATIONS AND STANDARDS

**NOTE: These standards apply at all flows unless specified otherwise.**

**RIO GRANDE BASIN:**

1. **The main stem of the Rio Grande from the International Boundary and Water Commission sampling station above American Dam at El Paso upstream to one mile below Percha Dam.**

   Designated Uses - Irrigation; limited warmwater fishery; livestock and wildlife watering; secondary contact recreation

   NOTE: Sustained flow in this stretch is dependent on release from Caballo Reservoir during the irrigation season; at other times of the year there is little or no flow; standards apply only at flows above 350 cfs.

   Standards:
   In any single sample:
   The dissolved oxygen shall be greater than 5.0 mg/l
   pH shall be within the range of 6.6 to 8.8
   Temperature shall not exceed 34°C (93.2°F)

   The monthly logarithmic mean of fecal coliform bacteria shall be less than 1,000/100 ml, and no more than 10% of the samples shall exceed 2,000/100 ml.

   At mean monthly flows above 350 cfs, the monthly average concentration for:
   TDS shall be less than 2,000 mg/l
   Sulfate shall be less than 500 mg/l
   Chlorides shall be less than 400 mg/l

2. **The main stem of the Rio Grande from one mile below Percha Dam upstream to the headwaters of Caballo Reservoir including Caballo Reservoir.**

   Designated Uses - Irrigation; livestock and wildlife watering; primary contact recreation; warmwater fishery

   NOTE: Sustained flow in the stream reach below Caballo Reservoir is dependent on release from Caballo Reservoir during the irrigation season; at other times of the year, there is little or no flow; standards apply to the stream reach only at flows above 350 cfs. Also, these standards do not apply in Caballo Reservoir at pool sizes below 25,000 acre feet.

RIO GRANDE BASIN:

Standards:

In any single sample:

Dissolved oxygen shall be greater than 5.0 mg/l except for brief periods (6 hours or less) of not less than 4.0 mg/l

pH shall be within the range of 6.0 to 9.0

Temperature shall be less than 32.2°C (90°F)

Turbidity shall be less than 50 FTU

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml

The open water shall be free of algae in concentrations which cause nuisance conditions or gastrointestinal or skin disorders.

3. The main stem of the Rio Grande from the headwaters of Caballo Lake upstream to Elephant Butte Dam.

Designated Uses - Fish culture; irrigation; livestock and wildlife watering; marginal coldwater fishery; secondary contact recreation; warmwater fishery

NOTE: Flow in this stretch is dependent upon release from Elephant Butte Dam. Standards apply only during flows in excess of 100 cfs.

Standards:

In any single sample:

The dissolved oxygen shall be greater than 5.0 mg/l

pH shall be within the range of 6.6 to 8.8

Temperature shall be less than 25°C (77°F)

The monthly logarithmic mean of fecal coliform bacteria shall be less than 1,000/100 ml, and no more than 10% of the samples shall exceed 2,000/100 ml.

4. Elephant Butte Reservoir

Designated Uses - Irrigation storage; livestock and wildlife watering; primary contact recreation; warmwater fishery

NOTE: These standards do not apply at pool sizes below 100,000 acre feet.

Standards:

In any single sample:

The dissolved oxygen shall be greater than 5.0 mg/l except for brief periods (6 hours or less) of not less than 4.0 mg/l

pH shall be within the range of 6.6 to 9.0

Temperature shall be less than 32.2°C (90°F)

Turbidity shall be less than 50 FTU

RIO GRANDE BASIN:

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

The open water shall be free of algae in concentrations which cause nuisance conditions and gastrointestinal or skin disorders.

5. The main stem of the Rio Grande from the headwaters of Elephant Butte upstream to the Angostura Diversion Works, including any flow below the perennial reaches of the Rio Puerco and Jemez River which enters the main stem of the Rio Grande.

Designated Uses - Irrigation; limited warmwater fishery; livestock and wildlife watering, secondary contact recreation

Standards:
In any single sample:
Dissolved oxygen shall be greater than 4.0 mg/l
pH shall be within the range of 6.0 to 9.0
Temperature shall be less than 32.2°C (90°F)

The monthly logarithmic mean of fecal coliform bacteria shall be less than 1,000/100 ml, and no more than 10% of the samples shall exceed 2,000/100 ml.

At mean monthly flows above 100 cfs, the monthly average concentration for:
TDS shall be less than 1,500 mg/l
Sulfate shall be less than 500 mg/l
Chloride shall be less than 250 mg/l

6. The Jemez River and all its tributaries above the Town of Jemez Springs and the Guadalupe River and all its tributaries and all perennial reaches of tributaries to the Rio Puerco.

Designated Uses - Domestic water supply; fish culture; high quality coldwater fishery; irrigation; livestock and wildlife watering; secondary contact recreation

Standards:
In any single sample:
Dissolved oxygen shall be greater than 6.0 mg/l or 85% of saturation, whichever is greater
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 20°C (68°F)
Total phosphorus shall be less than 0.1 mg/l
Total organic carbon shall be less than 7 mg/l

## RIO GRANDE BASIN:

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

7. The main stem of the Rio Grande from Angostura Diversion Works upstream to Cochiti Dam.

Designated Uses - Irrigation; livestock and wildlife watering; secondary contact recreation; warmwater fishery (coldwater fishery upon completion of Cochiti Reservoir)

Standards:

In any single sample:

Dissolved oxygen shall be greater than 6.0 mg/l
pH shall be within the range of 6.6 to 9.0
Temperature shall be less than 32.2°C (90°F)

The monthly logarithmic mean of fecal coliform bacteria shall be less than 1,000/100 ml, and no more than 10% of the samples shall exceed 2,000/100 ml.

8. Cochiti Reservoir.

Designated Uses - Livestock and wildlife watering; warmwater fishery; (coldwater fishery and primary contact recreation upon completion of reservoir)

Standards:

In any single sample:

The dissolved oxygen shall be greater than 6.0 mg/l
pH shall be within the range of 6.6 to 9.0

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

The open water shall be free of algae in concentrations which cause nuisance conditions or gastrointestinal or skin disorders.

9. The main stem of the Rio Grande from the headwaters of Cochiti Reservoir upstream to Taos Junction Bridge including the main stem of Embudo Creek from its confluence with the Rio Grande upstream to Dixon and the Santa Fe River upstream to Siler Road.

Designated Uses - Irrigation; livestock and wildlife watering; marginal coldwater fishery; secondary contact recreation; warmwater fishery

RIO GRANDE BASIN:

Standards:

In any single sample:

The dissolved oxygen shall be greater than 6.0 mg/l (except Santa Fe River upstream to Siler Road where dissolved oxygen shall be greater than 4.0 mg/l)

pH shall be within the range of 6.6 to 8.6

Temperature shall be less than 22°C (71.6°F) [except Santa Fe River upstream to Siler Road where temperature shall be less than 30°C (86°F)]

Turbidity shall be less than 50 FTU

At mean monthly flows above 100 cfs, the monthly average concentration for:

TDS shall be less than 500 mg/l

Sulfate shall be less than 150 mg/l

Chloride shall be less than 25 mg/l

The monthly logarithmic mean of fecal coliform bacteria shall be less than 1,000/100 ml, and no more than 10% of the samples shall exceed 2,000/100 ml.

10. El Rito Creek above the Town of El Rito and Vallecitos Creek above Ojo Caliente Creek and all tributaries.

Designated Uses - Domestic water supply; irrigation; high quality coldwater fishery; livestock and wildlife watering; secondary contact recreation

Standards:

In any single sample:

Dissolved oxygen shall be greater than 6.0 mg/l or 85% of saturation, whichever is greater

pH shall be within the range of 6.6 to 8.8

Temperature shall be less than 20°C (68°F)

Total phosphorus shall be less than 0.1 mg/l

Total organic carbon shall be less than 7 mg/l

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

11. The Rio Chama from its confluence with the Rio Grande upstream to El Vado and any flow below the perennial reaches of El Rito Creek and Rio Ojo Caliente which enters the main stem of the Rio Chama.

Designated Uses - Irrigation; livestock and wildlife watering; marginal coldwater fishery; secondary contact recreation

## RIO GRANDE BASIN:

Standards:

In any single sample:

Dissolved oxygen shall be greater than 5.0 mg/l
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 26°C (78.8°F) above Abiquiu Reservoir and less than 31°C (87.8°F) below Abiquiu Reservoir

The monthly logarithmic mean of fecal coliform bacteria shall be less than 1,000/100 ml, and no more than 10% of the samples shall exceed 2,000/100 ml.

12. All perennial reaches of tributaries to the Rio Chama above Abiquiu Reservoir and the main stem of the Rio Chama from El Vado upstream to the New Mexico-Colorado line, including El Vado Reservoir.

Designated Uses - Domestic water supply; fish culture; high quality coldwater fishery; irrigation; livestock and wildlife watering; secondary contact recreation

Standards:

In any single sample:

Dissolved oxygen shall be greater than 6.0 mg/l or 85% of saturation, whichever is greater
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 20°C (68°F)
Total phosphorus shall be less than 0.1 mg/l
Total organic carbon shall be less than 7 mg/l

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

13. All perennial reaches of tributaries to the Rio Grande in Santa Fe County except the Santa Fe River below Siler Road.

Designated Uses - Domestic water supply; high quality coldwater fishery; irrigation; livestock and wildlife watering; municipal and industrial water supply; secondary contact recreation

Standards:

In any single sample:

Dissolved oxygen shall be greater than 6.0 mg/l or 85% of saturation, whichever is greater
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 20°C (68°F)
Total phosphorus shall be less than 0.1 mg/l
Total organic carbon shall be less than 7 mg/l

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

RIO GRANDE BASIN:

14. The main stem of the Rio Grande from Taos Junction Bridge upstream to the Colorado-New Mexico line and the Red River from its confluence with the Rio Grande upstream to a point ½ mile above the Red River Fish Hatchery.

Designated Uses - Coldwater fishery; fish culture; livestock and wildlife watering; secondary contact recreation

Standards:
In any single sample:
Dissolved oxygen shall be greater than 6.0 mg/l
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 20°C (68°F)
Turbidity shall be less than 50 FTU

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

15. The Red River from a point ½ mile above the Red River Fish Hatchery upstream to its headwaters including all tributaries thereto and all other perennial reaches of tributaries to the Rio Grande in Taos County, including Embudo Creek above Dixon.

Designated Uses - Domestic water supply; fish culture; high quality coldwater fishery; irrigation; livestock and wildlife watering; secondary contact recreation

Standards:
In any single sample:
Dissolved oxygen shall be greater than 6.0 mg/l or 85% of saturation, whichever is greater
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 20°C (68°F)
Total phosphorus shall be less than 0.1 mg/l
Turbidity shall be less than 25 FTU
Conductivity shall be less than 300 umho
Total organic carbon shall be less than 7 mg/l

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

## STREAM USE DESIGNATIONS AND STANDARDS

NOTE: These standards apply at all flows unless specified otherwise.

PECOS RIVER BASIN:

1. The main stem of the Pecos River from the New Mexico-Texas line upstream to Malaga.

   Designated Uses - Irrigation; livestock and wildlife watering; secondary contact recreation; warmwater fishery

   Standards:
   In any single sample:
   Dissolved oxygen shall be greater than 5.0 mg/l
   pH shall be within the range of 6.6 to 8.8
   Temperature shall be less than 32.2°C (90°F)

   The monthly logarithmic mean of fecal coliform bacteria shall be less than 1,000/100 ml, and no more than 10% of the samples shall exceed 2,000/100 ml.

   At all flows above 50 cfs:
   TDS shall be less than 20,000 mg/l
   Sulfate shall be less than 3,000 mg/l
   Chloride shall be less than 10,000 mg/l

2. The main stem of the Pecos River from Malaga upstream to Lower Tansil Dam, including Black River.

   Designated Uses - Industrial water supply; irrigation; livestock and wildlife watering; secondary contact recreation; warmwater fishery

   NOTE: Diversion for irrigation frequently limits summer flow in this stretch to that contributed by springs along the watercourse. Suitable conditions for a warmwater fishery cannot be maintained during the summer unless there is significant release from lower Tansil Dam and Harroun Dam.

   Standards:
   In any single sample:
   Dissolved oxygen shall be greater than 5.0 mg/l
   pH shall be within the range of 6.6 to 9.0
   Temperature shall be less than 34°C (93.2°F)

# Appendix M

## Lake County Planning Commission
## RESOLUTION 75-127

WHEREAS the Planning Commission of the County of Lake, State of California has considered the application for a Use Permit as applied for by Burmah Oil and Gas Company, 2828 Junipero Avenue, Long Beach, California for geothermal drilling, completion and placing on production of nine wells on a certain 60 acre leasehold (Dillingham and Vought) in the Anderson Springs vicinity, otherwise described as Assessor Parcel Numbers 13-06-65 and 13-06-66, being portions of Section 27 and 34, Township 11 North, Range 8 West, Mt. Diablo Base and Meridian in accordance with the Lake County Ordinance Code, and

WHEREAS said Planning Commission finds that the establishment, maintenance or operation of the use for which application is made will not under the circumstances of this particular case be detrimental to the health, safety peace, morals, comfort and general welfare of persons residing or working in the neighborhood of such use, or be detrimental to the property or improvements in the neighborhood, or be detrimental to the general welfare of the County and that the proposed use is in substantial conformity with the Lake County General Plan and that the proposed use is not a trivial action with no significant impact on the environment, and

WHEREAS said Planning Commission has caused to be prepared a Draft Environmental Impact Report and a Final Environmental Impact Report on the subject of this application and has held public hearings thereon and has carefully considered this matter pursuant to the California Environmental Quality Act and the Guidelines of the Resources Agency, State of California, pertaining thereto, and pursuant to the Environmental Protection Guidelines as referenced in the Ordinance Code, County of Lake, now therefore be it

RESOLVED that the Planning Commission of the County of Lake approves the Use Permit applied for, and be it

FURTHER RESOLVED THAT:

I. This Use Permit has been approved by the Planning Commission, subject to being issued after the expiration of the mandatory appeal period and after compliance with any conditions precedent. However, if the Use Permit is not issued before October 9, 1976, it will become null and void, and the use may not proceed without the application for and approval of a new Use Permit. The Planning Commission may in its discretion approve time extensions.

II. The Use Permit shall be subject to the following conditions:

## Lake County Planning Commission
## RESOLUTION 75-127

CONTINUED

A. Nine (9) production wells on five drill sites for a period of two (2) years commencing on the date of approval of the Use Permit and further subject to approval of site regarding location for three (3) wells by the Planning Commission prior to any drilling or site preparation, specifcially wells numbered 7, 8 and 9, which may require additional drill sites as may be determined.

B. TO PROTECT PLANT ASSOCIATIONS:
   1. Top soil shall be stockpiled for later respreading over the disturbed area prior to re-seeding.
   2. Specific pad/road sites shall be evaluated by a qualified horticulturist-landscape consultant to determine which native plants can be tolerantly sustained.
   3. When construction/drilling has been completed, re-vegetation shall be programmed and shall commence in the fall of year following the construction or drilling.
   4. The re-vegetation program shall be re-evaluated during the second Spring following initial planting and if deemed to be inadequately successfull additional re-vegetation will be required in the immediately succeeding fall season.

C. TO PROTECT WILDLIFE HABITAT:
   Note: The E.I.R. on the basis of field reconnaisance, does not report the subject area as being likely habitat for rare and endangered species of animals. The report does not rule out the possibility but does not suggest any specific mitigating measures to protect them. Therefore, in order to minimize potentially adverse effects to the wildlife habitat generally, only one condition is recommended, although beneficent mitigations to wildlife are listed elsewhere.
   1. Not more than twenty-five (25) surface acres of the sixty (60) acre leasehold shall be disturbed by the construction of drill pads, sumps and access roads without the specific authorization of the Planning Commission.

D. TO PROTECTION AGAINST EXCESSIVE SOIL EROSION, INDUCED LAND SLIPS AND SURFACE GEOLOGIC HAZARDS:
   1. A Registered Civil Engineer and an Engineering Geologist shall certify all road excavation and site preparation plans.
   2. A precise survey of the drill sites, the positioning of the equipment and a reserve pit area, the access roads including the extent of cuts and fills, the compaction methods and the storm drainage design plan and profiles shall be submitted to the Lake County Director of Public Works in advance of any excavation.
   3. Filled slope banks shall not exceed 1 1/2:1. Edges of all fills shall be stabilized with rock and gravel or placed to reduce erosion potential to an absolute minimum on all fill slope banks. Revegetation of slopes shall be carried out as specified in Condition B.

4. A retaining levee of not less than eighteen inches (18") in height and three feet (3') in base thickness shall be placed on the perimeter of all fill areas to prevent storm runoff accumulation from random discharge.
5. A permanent silt trap of a design to impede the transport of silts from the area shall be installed and maintained on the upstream side of the Socrates Mine Road at its intersection with the principal watershed channel.
6. The drainage plan to be submitted will generally distribute storm water runoff over the downhill slope or collect runoff and channel it to existing natural waterways only to the extent that it will not increase water head to the point of unnatural channel abrasion. Energy dissipators and collection devices to reduce the erosive force of unnatural runoff may be required.
7. Drill pad locations shall be selected on areas of not more than an average of thirty percent (30%) natural slope without specific approval from the Planning Commission.
8. Steam well stimulation with the use of explosives shall not be permitted without specific approval from the Lake County Planning Commission.
9. All grading activity shall be completed and all drainage structures shall be in place and operational prior to October 10, of any year. Grading and excavation activity shall not be permitted during the consecutive period from October 10 to April 10 of any year. (It is understood that this is a general time frame. Extension beyond October 10 may be allowed by the Lake County Department of Public Works Director upon establishment of a soil moisture specification for any stated activity.

E. ENVIRONMENTAL AND SAFETY PROTECTIONS GENERALLY:

1. Engineered sumps shall be lined with impervious material to prevent any leaching of possible soil or water contaminants into local ecosystem.
2. Sump fluids (both mud and supernatant liquids) shall be monitored for type and quantity of biologically sensitive materials, especially toxic materials, heavy metals and radioactive materials. If said monitoring does not indicate quantities in excess of allowable limits for either human or other important biological elements, especially those of the acquatic ecosystem, then sump materials shall be solidified, dried, mixed with native soil and buried. If toxic or biologically sensitive materials are found, such materials shall be removed to a Class 2-1 disposal site as directed by the County or appropriate State agency. Sump pits shall be refilled to a self-stabilizing grade and be re-vegetated as required by Condition B.
3. No drill site shall be located within five hundred feet (500') of any creek flowing ten (10) months or more during the year without specific approval from the Planning Commission.
4. No hydrocarbon based cleaning agent, no waste oils or greases, no liquid fuel shall be discharged directly onto the surface of a drill pad. All such liquids shall be contained and removed from the site.

5. All unattended drilling equipment, well heads, sumps, ponds, shall be protected from access by unauthorized persons.
6. The applicant shall comply with the requirements of fire prevention practices and measures as may be prescribed by the Chief, Middletown fire Protection District and/or the California Division of Forestry.
7. Sanitary and hand washing facilities shall be provided at the drill sites and maintenance yards as specified by the Lake County Health Department.
8. In the event of casing blow-out or other uncontrolled venting, applicant shall move immediately to control the vent. No more than five (5) days shall elapse from the date of the uncontrolled vent to the date of equipment relocation to secure it.
9. Alternate sites for water source shall be approved by the Planning Commission.
10. Water trucks shall operate only during daylight hours.

F. TO PROTECT AIR QUAILTY:

1. The applicant shall meet the Ambient Air Quality Standards established by the Lake County Air Pollution Control District Regulations.
2. It is stipulated that the said District will be spot monitoring climatic conditions, quantities of non-condensible gasses in the vicinity of the proposed use and that the findings resulting from said monitoring may require the applicant, his contractors or agents to provide continuous air quality monitoring and sample readings as may be directed by the Lake County Air Quality Pollution Control District.
3. Applicant shall secure a Permit to Operate from the Lake County Air Pollution Control District prior to commencement of drilling activity.
4. Applicant shall provide dust control measures on all vehicular access routes as may be required by direction from the Lake County Air Pollution Control District.
5. Applicant shall provide, upon request from the Lake County Planning Commission, element-component readings from a steam analysis.

G. TO PROTECT AGAINST EXCESSIVE NOISE EXPOSURE:

1. The maximum permitted sound level during any phase of the operation shall not exceed 65 db (A) at a distance of one-half (1/2) mile from the drill site.
2. It is stipulated that the Lake County Air Pollution Control District will be spot monitoring noise levels in the vicinity of the proposed use and that findings resulting from said monitoring may require the applicant, his contractors, or agents, to provide continuous noise level monitorings and readings as may be directed by the Lake County Air Pollution Control District.
3. Applicant shall install a separator-muffler device to contain all discharges during the drilling and testing phase.

H. TO PROTECT VIEWS AND SCENIC VISTAS:

1. Drill sites 7, 8 and 9 shall be relocated as recommended on Figure 6, page 16 of the referenced E.I.R. to avoid adverse

geologic soils and view impact.

I. IN GRANTING THIS USE PERMIT THE LAKE COUNTY PLANNING COMMISSION MAKES THE FOLLOWING FINDINGS:

1. That this Use Permit does not abridge or supersede the regulatory powers or permit requirements of any State or Federal Agency or any Special District or other Lake County Department or Division which may retain an advisory or regulatory function as specified by statute or ordinance, nor does this Use Permit grant any title or other real property right solely to this applicant or his assigns.
2. That the granting of this Use Permit is in the general public interest and that environmental and performance parameters conditioning the proposed activity as specified in this Use Permit and as contained in that document entitled, "Conditions, Procedures and Performance Standards for Geothermal Regulations, County of Lake", now referenced and made a part hereof, will allow the proposed activity with adequate safeguards to the welfare of the people of Lake County at large and to the people residing in the vicinity of said activity.
3. That this Use Permit shall be subject to revocation or modification by the Board of Supervisors of Lake County if:
    a. The Board finds that there has been non-compliance with any of the foregoing conditions, or
    b. The Board finds that the use for which this permit is granted is so exercised as to be substantially detrimental to the general public or to property in the vicinity of the use.

    Any such revocation shall be taken pursuant to Section 21-84 of the Ordinance Code of the County of Lake.
4. That this Use Permit is issued for a period of two (2) years and shall expire on October 9, 1977.

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The foregoing resolution was introduced by Commissioner Dennis Bailey who moved its adoption, seconded by Commissioner Richard Broten on this 9th day of October, 1975, and carried by the following roll call vote:

AYES: Commissioners Dennis Bailey, Richard Broten, Al Moorhead, Harvey Sampson, and Chairman Nancy Stolesen
NOES: None
ABSENT: None

WHEREUPON the Chairman declared the above and foregoing resolution duly adopted.

SO ORDERED!

Lake County Planning Commission
Nancy Stolesen, Chairman
Doris W. Wilcox, Secretary

AFFIRMATION: I have read the above conditions and will comply.

Signature of Applicant